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What are the reasons for replacing obsolete equipment?
How soon should new equipment pay for itself?
What are the steps taken in buying equipment?
Is group or individual motor drive preferable?
Is a repair cost record worth while?
How are obsolete machines disposed of?
What are the faults of machine tools?
How keep informed of developments in equipment?

Conclusive answers to these questions are of extreme importance to the user of shop equipment. The answers have been given in the *American Machinist* in its series of articles, "Getting the Most Out of Your Machine Tool Dollar." But not all of the leaders of the machinery industries think alike on such subjects and the problems are likely to require different answers in different plants. Therefore cross-sections are presented here of the articles as a whole, the statements of company policies being quoted or abstracted, as they apply to the several questions.

In this article, the FIFTH *of a series of eight, answers are given to the question*

Is a Repair Cost Record Worth While?

The International Harvester Co. uses the costs of repairs in deciding whether to work machines to the limit of their capacity (with consequent higher maintenance cost), or keep them well within their limit (with low maintenance cost). The expense for repairs is considered also, in disposing of worn machines.

SKF Industries—A budget for machine repairs is maintained by SKF Industries: "It is made up from past records, so that it is not merely an arbitrary figure. Any machine on which the repairs exceed the budget is due for some careful observation, and if the situation continues it is quite likely to be taken as a warning that a piece of new equipment is necessary." A record of the cost of repairs to individual machines is kept. It is used when figuring on new equipment.

Delco—Since the beginning of the Delco (Dayton Engineering Laboratories) plant, a machine record has been kept, showing, among other data, the charges for all maintenance and overhauling expense. This company budgets its payroll for repairs: "Our repair cost records . . . serve as a guide as to the time when a machine should be placed in the obsolete class. They serve also as a guide in the matter of rebuilding, of which we do probably more than the average amount. We consider repair costs so important that we budget the payroll of the repair department monthly, projecting the budget three months ahead. The budget is based on productive labor according to our output schedule. When the cost of the repair payroll exceeds the budget allowance, one or both of two things must be wrong. Either our repair gang has not worked efficiently or we are repairing where we should be buying, or both. Since we are able to check our repair labor very closely, we are most likely to find that we are nursing along some machines that we should be better off without."

The Westinghouse Electric and Manufacturing Co. places a great deal of dependence upon its repair cost record in selecting new equipment. "To aid the supervisors in selecting the proper tools, a record is maintained, in the machine repair department, of each tool, showing the make and cost, the repairs and adjustments made, and the cost of such repairs and adjustments. At any time it is possible to go to this record and ascertain what repairs have been made to a machine tool. It is a record that is very valuable to the works equipment department in selecting new equipment, as any weakness in machine tool design or construction is indicated by the frequency of repairs to certain parts."

The Timken Roller Bearing Co. is keeping an experimental record of repairs. The indication is that repair costs of more than ten per cent for six months, based on original cost, are too high, indicating that the load is too great, or that a new machine is needed. In that way the repair cost record is being used as a barometer.

General Electric—Records that show every dollar spent on a machine tool for any purpose from the time it was installed are maintained by the General Electric Co. These records are used to show when a machine tool is not earning its keep.

Hupp—The machine repair department of the Hupp Motor Car Corporation makes a monthly repair expense report to the foremen. From this report the foremen discover which machines are costing too much for repairs and with this information as a basis, place requests for new equipment.

Western Electric—Maintenance costs on each class of machine of the Hawthorne Works of the Western Electric Co. are reported monthly. "From these records it is possible to set up an automatic expense budget that varies with the activity of the various respective departments. Any considerable deviation from the budget figures results in an investigation and may lead to machine replacements."

The Gleason Works does not maintain a repair cost record with the costs distributed against the individual machines, because experience has indicated that it is not necessary to do so. However, the individual items of expense for repairs are labeled with the numbers of the machines on which they are incurred, so that at any time there can be compiled a total cost of repairs for any machine from the time it was received in the plant.

The Testing of Gas Welds

By H. L. Whittemore

THE extensive use of oxygen for cutting ferrous metals, using apparatus and technique similar to those used for gas welding, makes it almost inevitable that cutting and welding should work together on many jobs. The simplicity of this gas apparatus, and the ease with which it can be used, makes it particularly adapted for frontier conditions.

Under more settled conditions, but where there is great competition, gas welding is widely used, particularly for thin and for non-ferrous metals. Many steam pipe lines, where the pressure and temperature are unusually high, are gas welded. In aircraft, where safety receives first consideration, the tubular steel fuselages are gas welded almost exclusively. The Fokker Co. lists the outstanding advantages of fuselages fabricated from steel tubing as: Maximum resistance to collapse in a crash; minimum damage; minimum expense for repairs. This company states that any mechanic can in a few hours be taught to weld sufficiently well to make permanent, quick, and clean repairs to the fuselages, with a minimum of equipment.

Courses in welding seem to be a necessity. Welding schools already have been successfully carried out on large jobs. A striking example is the school established by the Linde Air Products Co., in connection with the installation of 200 miles of pipe line in the southwest. Welded joints were used throughout this job, and most of the welding was done by men hired locally, who had never held a torch before they reported at the school. Working under the supervision of experienced, intelligent welders, some of these men were able to complete their training in a few weeks. Each joint on the line as it was made was marked with the welder's number, so that responsibility could be readily fixed for any failure. The interest and sense of responsibility developed in the school paid gratifying returns on the job.

While we wait for non-destructive test for welds, which is commercially practical, we must content ourselves with the usual laboratory tests. For a rough check on the quality of a weld the cold bend test has proved valuable. I hope to see most welding shops using some simple testing machine that gives numerical results.

The great disadvantage of specimens made expressly for test is that they do not necessarily represent the regular output of the welder. Although impact specimens can be cut from a structure such as a tank, this method is not practical in most cases. Whether or not specimens for test truly represent the work the welder is doing depends largely upon the moral qualities of the welder. Welding for the best results requires workmen who realize the responsibilities placed upon them, and who will not do work that they know is unsatisfactory.

The methods at present in use for measuring the physical and metallurgical properties of metals seem to be satisfactory for the examination and testing of welds, but too often only the ultimate strength of a weld is determined when the proportional limit is of equal importance. Moreover, the small amount of weld metal in the joint makes it difficult to measure the elastic properties of the weld itself.

When investigating the behavior of welded structures under load the hand strain-gage should be used. Even if no claim for high precision can be made for the stresses determined in this way, regions of high stress become apparent, and the information provides a basis for changes in the design or in the method of welding. Examination of a structure that has failed under load seldom shows where the stresses become excessive.

One objection to welding, which does not apply to other methods of fabrication, is that the process causes initial stresses in the structure, the magnitude of which are unknown. The strain-gage can be used to measure these stresses if measurements are taken on the same gage lines both before and after the structure is welded.

Of the tests which have been proposed, the three outstanding ones are: The electrical resistance method, magnetic analysis, and X-ray examination. The electrical resistance across a weld can be accurately measured even when the weld is part of a structure. The difficulty is not in measuring the resistance, but in finding a relation between the resistance and the strength of the weld. This method does not offer a solution.

Measurement of the magnetic flux in ferrous metals under a constant magnetizing force has all the requisites except one for a non-destructive test of welds. It is inexpensive, rapid, and can be used almost anywhere, but it does not indicate defects infallibly. However, it errs on the safe side, and it is now being used. But where the thickness and contour of the metal vary it is difficult to see how this method can be used.

Extracted from a paper presented at the meeting of the International Acetylene Association, at Chicago, Nov. 11, 1926.

Pneumatic Tools on the Oregon Short Line

By L. C. MORROW
Managing Editor, American Machinist

Face grinder especially valuable in finishing welded spots—An easy way to grind-in superheater headers—Taking the work out of grinding throttle valves and standpipes—Three keyway tools

ONE of the drawbacks to the locomotive cylinder bushing that has been repaired by welding is the difficulty of finishing the end to a plane surface. The single-point tool, commonly used, has a tendency to ride over the welded spots. To insure a plane surface that will permit of steam-tight joints, the shops of the Oregon Short Line of the Union Pacific System, at Pocatello, Idaho, have designed, and are using, the pneumatic cylinder-face grinder illustrated in Fig. 1. While the tool shown in the halftone gives a good job, its set-up and operation are not as convenient as desired, and improvements have been incorporated in a later tool, as shown in the accompanying line cuts, and on which the designer has asked for patents. The improved tool was not available when the photograph was taken.

In setting-up the old tool it was necessary to spend much time in centering the shaft; the air-hose connection at the motor was of the rigid type, with the result that the hose wound around the shaft as the motor was revolved; and the depth of cut could not be controlled conveniently. However, the tool was considered experimental, and with the principle established, the improvements were put under way. On the new machine, the shaft is automatically centered by turning the handwheels shown in Figs. 2 and 3; a swiveling connection is provided for the air-hose; and the motor is mounted on a slide, provided with a feed screw. Also, in Fig. 3, additional details are shown.

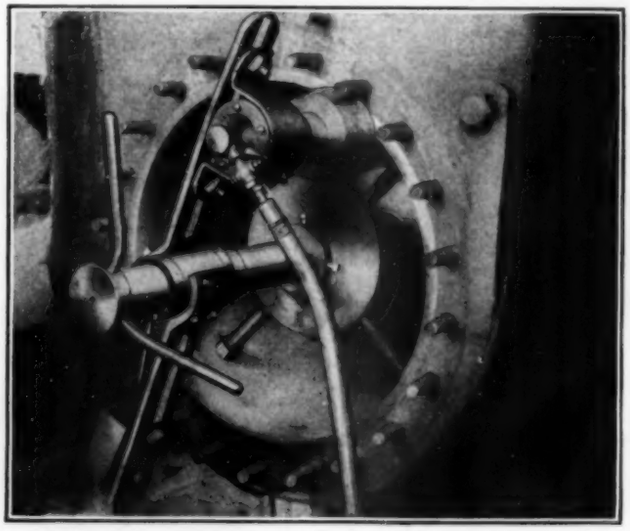


Fig. 1—Pneumatic tool for grinding the ends of bushings

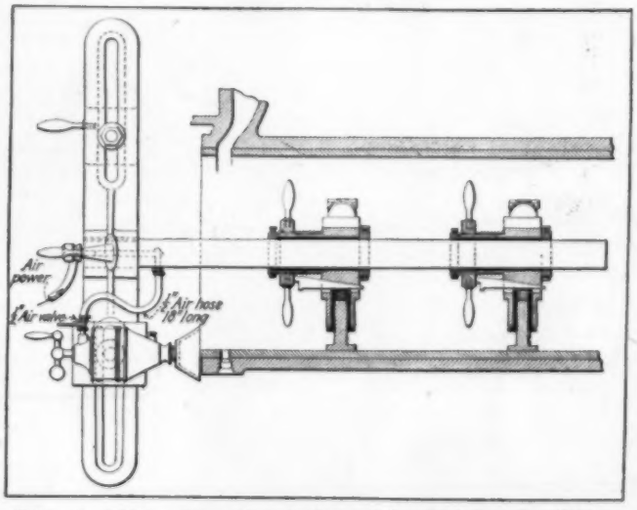


Fig. 2—Plan view of grinder with section of cylinder

It is considered desirable to finish the end of the bushing with a slight angularity, and the motor is held to the rotary arm by a single bolt, to make angular adjustment a convenient and rapid operation. A 6-in. Aloxite cup wheel is used. The motor and wheel are counterbalanced by a weight adjustable along the rotary arm.

How driving axles are quartered is shown in Fig. 4. With the axle mounted on the lathe centers and clamped by the chuck jaws, the end mill, with power supplied from an air motor mounted on the tool slide of the machine, is fed in to depth and then the carriage is traversed longitudinally until the keyway has been completed. Since there are no layout lines, the keyway is allowed to come where it will, circumferentially. The keyway in the opposite end, of course, must be located 90 deg. around the circumference with respect to the first keyway. To effect the quartering, the axle is reversed in the lathe and is located in the new position by a key carried in a stand held to the ways of the machine near the chuck. The key slides vertically in the stand and enters the keyway already cut. In addition to its locating function, the stand assists the chuck

in holding the axle against the cut, by means of two setscrews, one of which is shown in the illustration. Even though the set-up does not require very much time, work is routed, whenever possible, to have several axles go through the quartering operation in one lot.

An attachment has been added to this quartering tool to be used in cutting keyways for eccentrics for the Stephenson valve gear. A dial indicator is used to show, in degrees, the locations of the keyways.

Grinding superheater headers to receive the tube ends

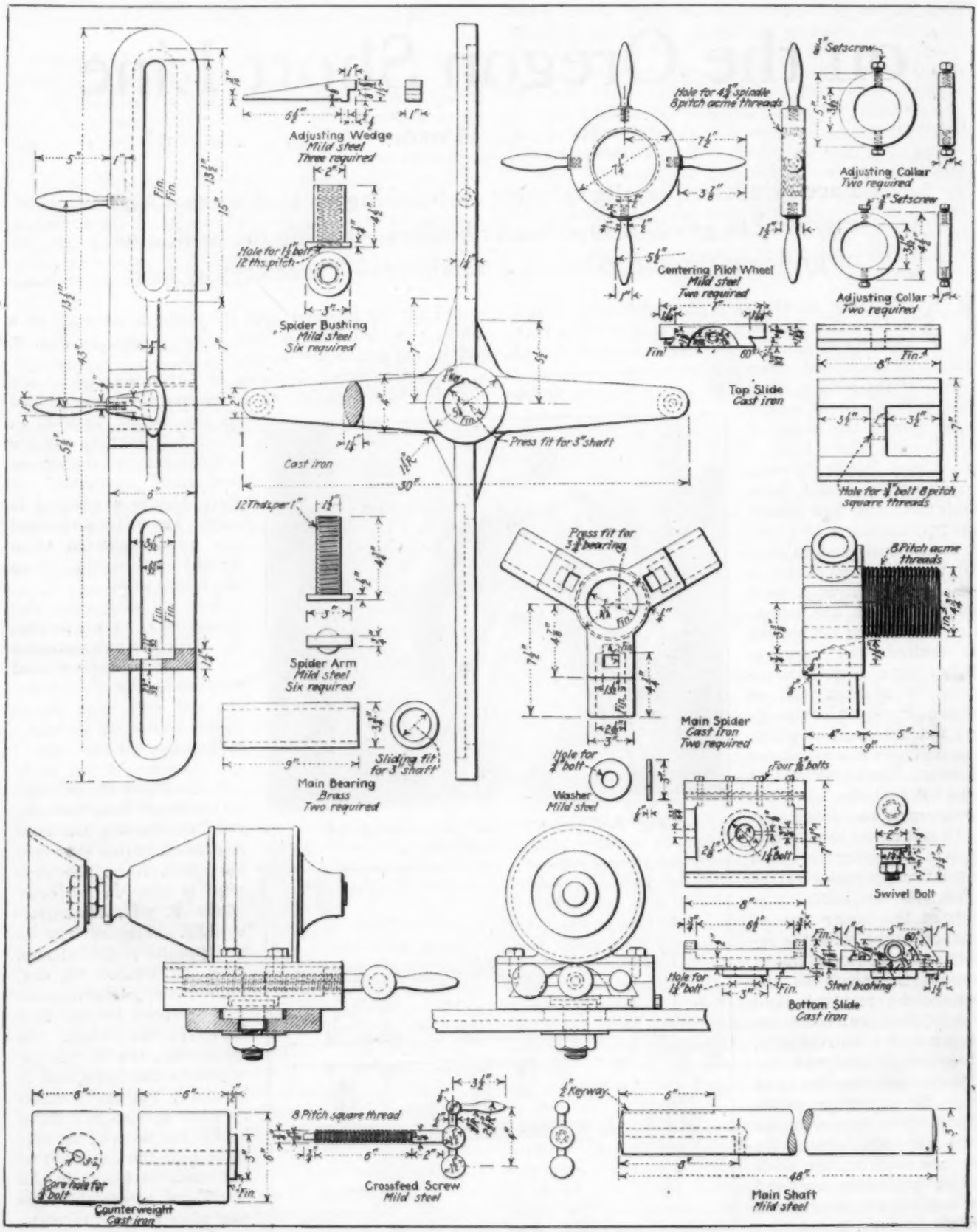


Fig. 3—Details of cylinder-bushing grinder

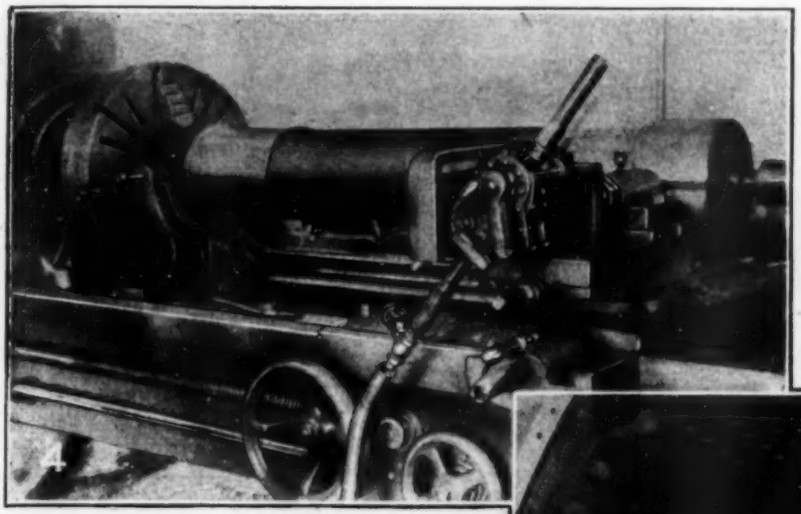


Fig. 4—Set-up of pneumatic tool for milling keyways in driving axles

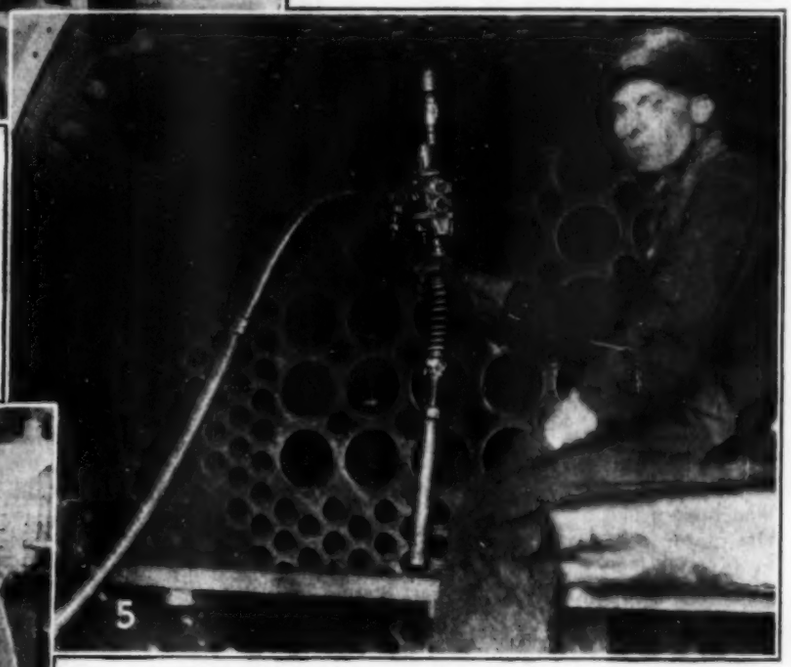


Fig. 5—Grinding-in superheater headers

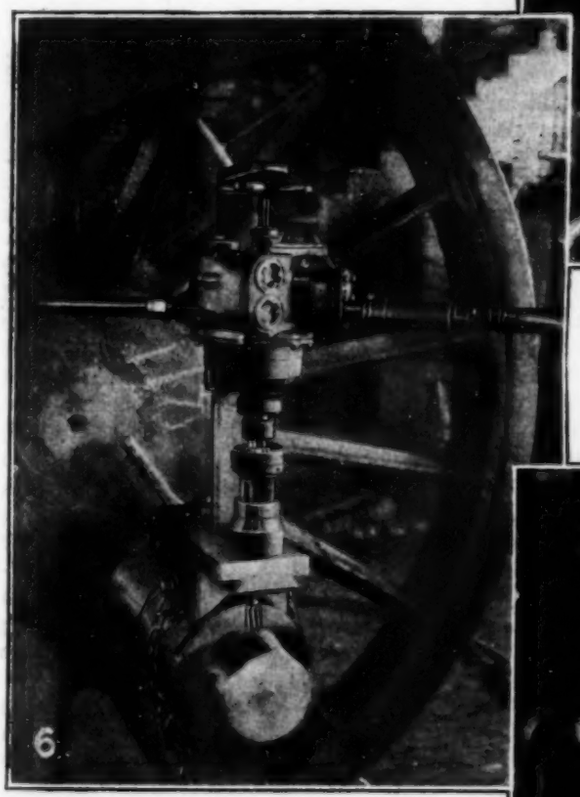


Fig. 6—Milling a keyway in a crankpin

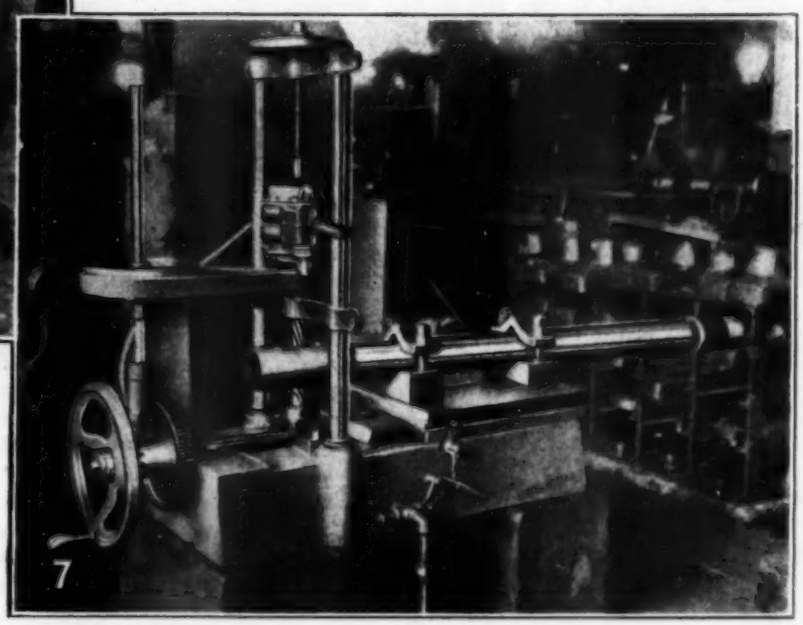


Fig. 7—Milling keyway in piston rod

is done as shown in Fig. 5. Attached to the handle of the air motor is an extension, consisting of a spring, a threaded rod for adjustment, and a pipe carrying a center. The spring is welded to the handle and to the threaded rod, and the center is welded to the pipe. In operation, the center rests on a plank extending across the boiler. The operator grasps the handle where it joins the spring and imparts a rotary motion to the motor. The grinding tool is a case-hardened hemisphere threaded to receive a shank that is gripped at one end in the chuck of the air motor. Abrasive mixed with oil is the grinding medium.

Use of a pneumatic tool for milling keyways in crankpins, after they have been pressed into the driving wheels, is illustrated in Fig. 6. The device is self-contained, the slide which furnishes the feed serving also to support the bracket (essentially an "old man") against which the end thrust of the cut is taken. The base on which the slide is traversed is held to the crankpin by chain and link, the link being provided with a tension screw. Feeding of the slide is brought about by a screw turned by means of a handle at the rear of the slide.

Keyways in piston rods are milled on a machine that also makes use of an air motor. As shown in Fig. 7, the motor is mounted vertically between two uprights, is supported at top and bottom, and can be raised for insertion or removal of the cutter. The helical mill is, of course, supported at the outer end. Power feed is obtained through wormwheel and worm, the worm shaft being driven by belt from the motor. Knock-out is automatic, the tripping action serving to shut the air valve, so that the motor stops running. Since all power is obtained from the motor, there is no further movement of any part of the mechanism. It will be noticed that one V-block is slightly higher than the other to secure the taper at one end of the keyway. Floor to floor time for the largest keyway cut on this machine, 1¼x5 in., is 45 minutes.

One of the chief advantages of the throttle-valve and standpipe grinding machine illustrated in Fig. 8 is that an operator will stay on the job, whereas he would not when it was necessary to grind them by hand. Another advantage is the great saving in time. In the hand operation only one valve or one standpipe could be worked on at a time. With the machine, three valves and three standpipes are ground simultaneously, and the operator does other work besides. The throttle valves are ground to their seats on the upper part of the machine and the standpipes are ground on the lower part.

The source of power is the air motor shown at the left, which revolves a cam shaft. An auxiliary shaft is operated from the cam shaft by means of sprockets and chains. The auxiliary shaft is connected to another shaft through gears, this third shaft being called the index shaft. Brackets supported on a jackshaft near the top of the machine, and attached to horizontal levers actuating the index plates, are given a limited motion by cams on the camshaft, and cause the levers to turn the index plates back and forth through about 40 deg. Cams, mounted on the index shaft, kick up the vertical rods that may be seen just below the horizontal levers. This movement is timed, by means of the gears referred to, with the action of the cams that control the oscillations of the index plates.

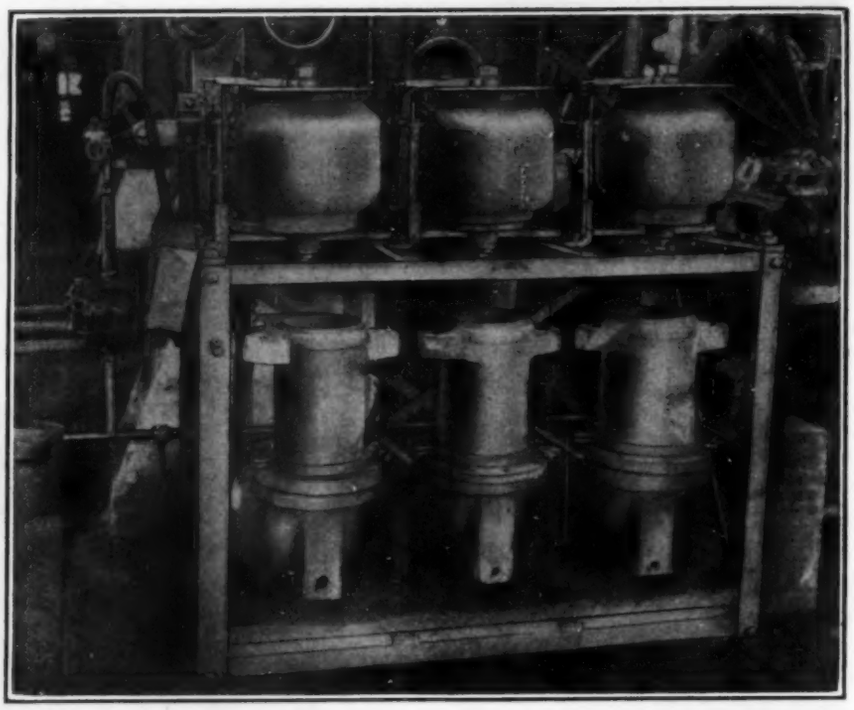


Fig. 8—Air-driven machine for grinding-in throttle valves and grinding standpipes to the throttle-valve bodies

The action of any of the three units of the machine is as follows: The cam on the index shaft lifts the horizontal lever, just before it is drawn to the rear, and holds it up during three backward and two forward strokes. At the end of the third backward stroke the lever is allowed by the cam to drop. A pin in the lever enters a hole in the index plate, and on the forward movement of the lever the plate is rotated through several degrees, causing the valve, to which it is attached, to take a new position. The lever is then again lifted by the cam to make the indexing pin inactive through the five strokes as before. There are 35 holes in the index plate, and the pin is carried back three holes for each indexing. Thus the valve is given a partial revolution several times in each of the successive positions in its seat. The valve is held to the index plate by a long bolt, a wooden disk 1-in. thick being placed between the two, to hold the plate away from the valve body.

There is another auxiliary shaft, near the base and to the rear of the machine, connected to the camshaft by a link, to which sufficient motion is imparted by a cam to cause the standpipes to oscillate through a few degrees. Since the pipes are to be bolted to the valve bodies, there is no necessity for complete rotation during the grinding-in process. The standpipes are connected with the auxiliary shaft by means of the horizontal levers and ring clamps shown in the illustration.

There was once a man who found a fat worm eating his cauliflower plants. He did not swear at it but took it out to the lake and caught with it fish that supplied food for his family of six. That is initiative!

Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
Electrical Engineer, Niles-Bement-Pond Co.

D. C. motor voltages and speeds—Motor ratings a function of time and temperature—Mounting and position—Anti-friction bearings—Proper motor protection

ANY well-designed motor should be capable of operating satisfactorily on a voltage 10 per cent above or below that for which it was designed. When operating on any voltage other than that for which it was designed, a motor will have characteristics somewhat different from those that it has when operating on normal voltage, but this change usually will not be serious. Where the voltage variation is over 10 per cent, special motors are advisable.

The usual d.c. voltages are 115, 230, 440, and 550, but the majority of d.c. wired shops use 230 volts. Motors for 115 volts are entirely satisfactory, although the amount of copper required for feeders for a 115-volt system is so great that this voltage is seldom used. Constant-speed motors for use with 440- and 550-volt circuits are entirely satisfactory, and the adjustable-speed motors are good if the speed range is not too great, but the voltage is too high and too apt to cause trouble. Such voltages should not be used if it is possible to arrange for 230 volts, especially since 550 volts is dangerous to life, while 230 volts is not under ordinary conditions. The speeds of d.c. motors are not fixed by any inherent characteristics of the motor, but by agreement among the motor manufacturers they corresponding with the full-load speeds of 60-cycle a.c. motors. For standard constant-speed motors, the full-load speeds are 1,750, 1,150, 850, and 575 r.p.m. For adjustable-speed motors, the usual speed ranges are 300 to 1,200, 400 to 1,600, 500 to 1,500 and 600 to 1,800 r.p.m. In some sizes ranges of 450 to 1,800, 550 to 1,650 and 650 to 1,950 r.p.m. are used. Reversing motors for driving planers and similar machines have a speed range of 250 to 1,000 r.p.m., although, when the Ward-Leonard system with individual generator sets is used, speed ranges of 166 to 1,000 and 200 to 1,200 r.p.m. are used by some manufacturers. A complete motor rating must specify the horsepower; the temperature rise; the time in which that temperature rise will occur with the motor driving a continuous load of rated horsepower; the speed at which the test is to be made; the voltage and the current; the phase and the frequency, if alternating current; the winding of the motor; and the type covers, if any. Torque motors, although usually given a low arbitrary horsepower rating, may be more accurately rated on a torque basis. The most important points in regard to a torque motor are the voltage, the stalled torque, and the stalled current. Most motors, however, are marked in conformance with the Electric Power Club rules, which require a horsepower rating.

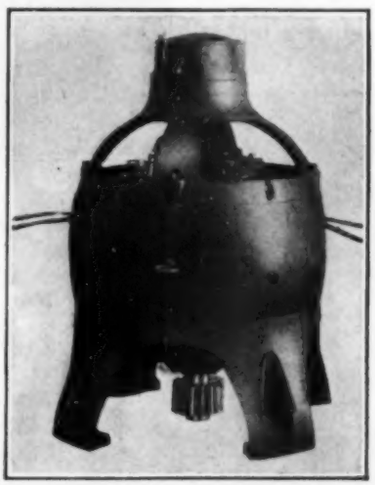
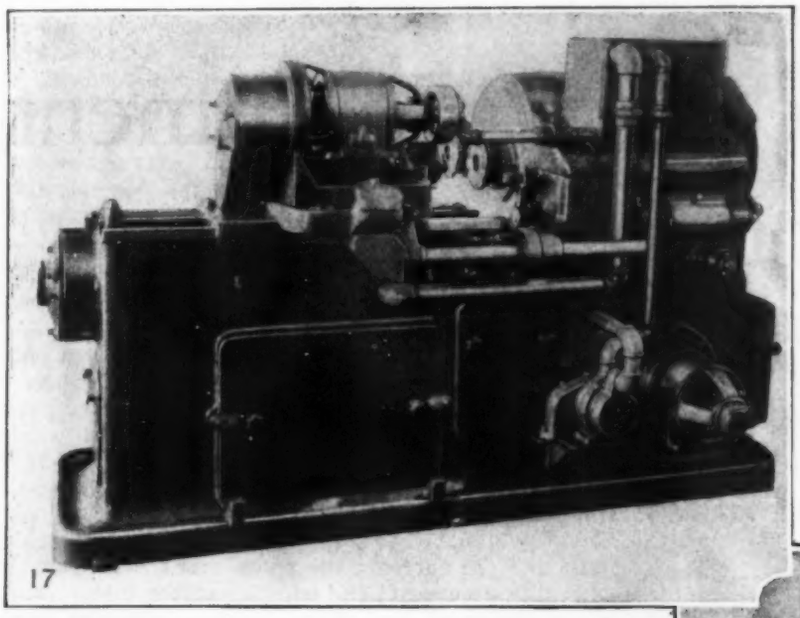


Fig. 16—Vertical ball-bearing motor

The usual machine-tool motor rating is based on a temperature rise of 50 deg. C. of the armature and field windings after a test run at full load at the given speed for a period of one hour, with the temperature of the surrounding air not greater than 40 deg. C. The covers, if any, with which it is to be normally operated, are in position during this test. Adjustable-speed d.c. motors used on lathes, boring machines, planers and similar machines are always so rated. Constant-speed motors are not usually so rated by most of the electrical companies but they may be obtained with a rating on this basis. It is believed that it is desirable to be able to obtain any type of motor so rated. Very few machine tools have duty cycles that require more than a one-hour 50-deg. C. rating motor. Only machines that may develop full power for several hours without any break, as is the case with some types of milling machines, such as rod millers, or the continuous, drum-type machines, should be equipped with continuous-duty motors. Usually the same motor is rated in one manner for one condition of load and temperature, and differently if there is a variation in the temperature and the time the load is to be carried. For example, one manufacturer rates a 550- to 1,650-r.p.m. direct-current motor at 10 hp., 40 deg. C. continuous rating; 12½ hp., 50 deg. C. continuous; 14 hp., 50 deg. C. 2 hr.; and 15 hp., 50 deg. C. 1 hr. The same motor would have about two-thirds the above horsepower rating if fully inclosed. On the other hand, it might be rated as high as 20 hp. on a 5-minute basis. Usually an a.c. motor cannot be rated more than 50 per cent above its 40-deg. continuous basis,

The third article. The fourth will appear in an early issue.



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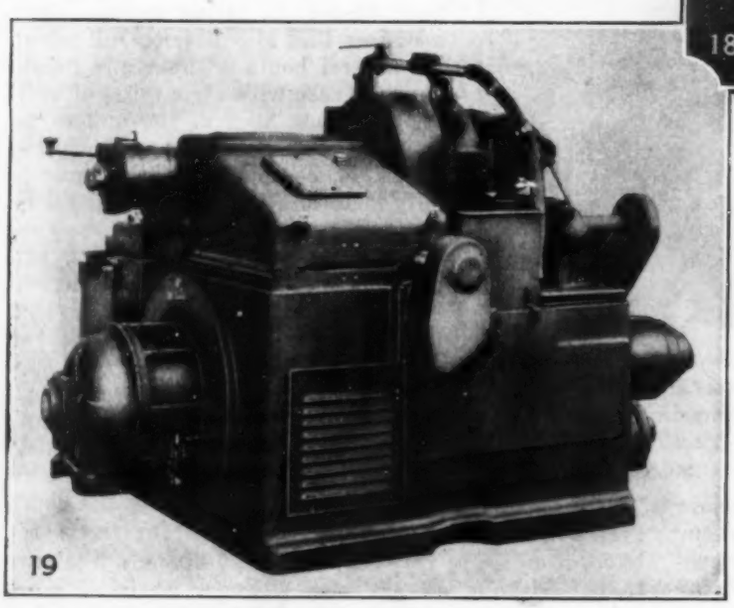
even if time and temperature are changed, because of the torque characteristics of this type of motor. It will be seen from the above statements that it is very important not to specify a higher time rating for a motor than is actually necessary, if it is desired to keep the electrical equipment at a minimum cost. Especially in the case of a.c. motors, one running at light load is inefficient. Consequently a small motor, loaded near its rated load, is both cheaper in first cost, and cheaper to operate than a larger motor on the same machine. Where a.c. induction motors are used, the power factor is also lowered by the use of too large a motor.

The usual motor is of the horizontal type in which the shaft is parallel with the mounting surface. The end frames are removable and may be rotated at 90-deg. intervals. Thus the same motor may be used for floor, ceiling or wall suspension by adjusting the end frames so that the oil wells will be upright with the motor feet in the required position. Most of the motor manufacturers build



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vertical motors, that is, motors with the axis of rotation vertical to the plane of mounting. These motors usually provide thrust bearing capacity for the weight of the armature only. Such a motor provided with ball bearings, is shown in Fig. 16. This motor may be set with the armature horizontal, with the motor foot bolted to a pad on a machine, as the two motors on the thread hobber, Fig. 17, are mounted. At times this makes a very good mounting for a motor. Not all vertical motors will run in this position, as the bearings on vertical motors are not always designed to take the weight of the armature where the motor is operated with the

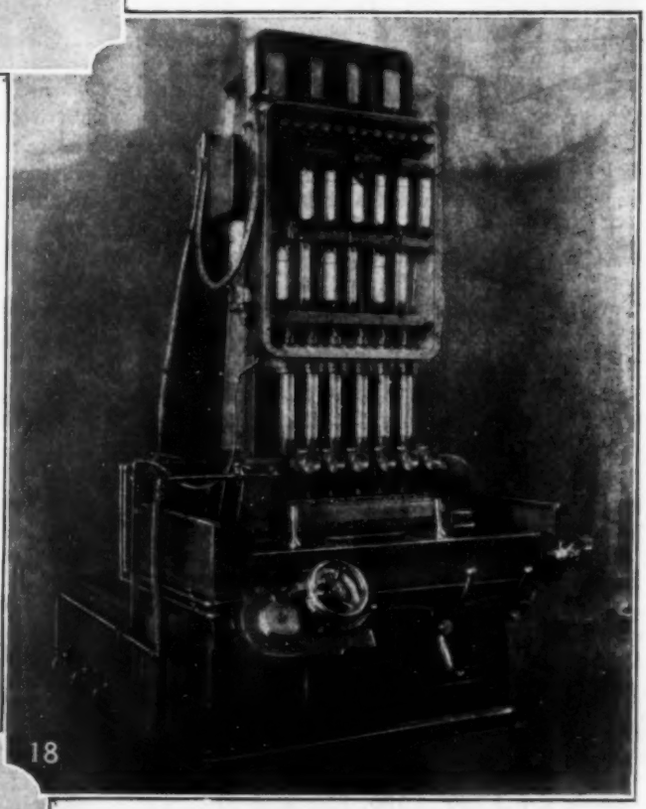

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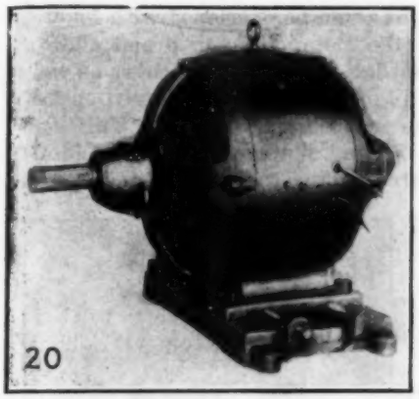
Fig. 17—Application of horizontal motor with vertical-type end-bell supports to a thread-hobbing machine

Fig. 18—Automatic cylinder-grinding machine with built-in motors on spindles

Fig. 19—Motor with frame specially designed for mounting in grinding machine

shaft horizontal. Before making an installation of this sort, it is advisable to consult with the manufacturer of the motor in question. To make the motor terminals accessible for convenience in wiring the machine, it may be desirable to interchange the end



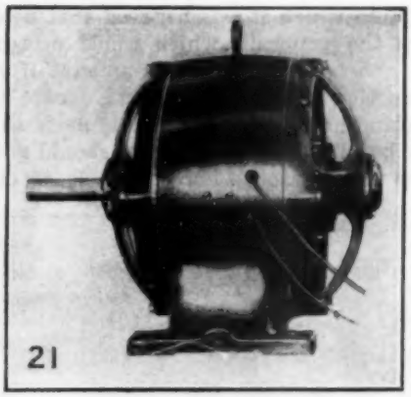


Fig. 20—Motor with plain, or sleeve bearings. Fig. 21—Motor with ball bearings

frames and reverse the armature. In the case of squirrel-cage induction motors, the end frames are usually identical, and the rotor may be reversed after removing one end frame.

Small motors, particularly small squirrel-cage induction motors may be obtained without the frame. That is, the rotor, without shaft, and the stator laminations and windings may be obtained separately. These small motors have been standardized by the more prominent electrical manufacturing companies, so that a machine builder may design the motor frame as part of the machine. This makes a very compact unit that is particularly adaptable to high-speed machinery. Such a design is largely used at present by the manufacturers of woodworking machinery, and it is believed to be very suitable for the simplier types of grinding and drilling machines. In the larger sizes, where dimensions are not standardized among the companies, this construction makes it difficult to change from one make or size of motor to another make or size. In Fig. 18 are shown six motors built into the feed of a machine to grind simultaneously all the cylinders of an automobile engine.

Motors may be obtained with lugs around the outside of the field yoke, and without feet, so that the motor may be set part way into the machine. These motors have the shaft vertical to the supporting surface, and may be mounted with the shaft horizontal or vertical. They are special in any case and deliveries are usually long. This same result may be obtained by having a motor without feet, and by providing a special adapter plate. Fig. 19 shows an a.c. motor attached in this way to a grinding machine.

Motors are made with either sleeve bearings, or with some type of anti-friction bearings. The sleeve-bearing motor has been in use the longest time and is still the more usual, although there seems to be a strong trend toward the use of some form of anti-friction bearing. For work in which there is considerable shock load on the motor, it is believed that the sleeve-bearing motor is preferable, as the oil film, if properly maintained, seems to cushion the bearing metal against the shocks, while the ball bearing, with metal to metal contact, transmits shocks, sometimes with disastrous results. Roller bearings are more successful for use in motors subjected to shock than ball bearings.

Ball-bearing motors usually will run satisfactorily for a longer time without attention than will sleeve-bearing motors. This is at least partly due to the fact that ball bearings are sealed against dirt, while the majority of sleeve bearings are not. Ball bearings, on the whole, are less apt to give lubrication trouble than sleeve bearings as has been proved in frequent instances, particularly in steel mills. After a sleeve-bearing motor that has given constant bearing trouble has been equipped with ball bearings, it will run for a much longer period between bearing replacements. Ball or roller bearing equipped motors also give less trouble because of the leakage of oil or grease from the bearings on to the windings than do sleeve bearing motors. Another advantage, which at times is important, is the decreased overall length of a motor obtained by the use of ball bearings. This is well shown by a comparison of Figs. 20 and 21, which show similar motors, one with sleeve bearings and the other with ball bearings. This difference is very appreciable as the ball bearing motor is always several inches less in length than the sleeve bearing motor in the ordinary industrial horsepowers. This decrease in length at

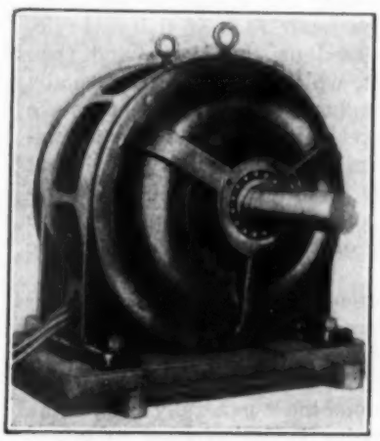
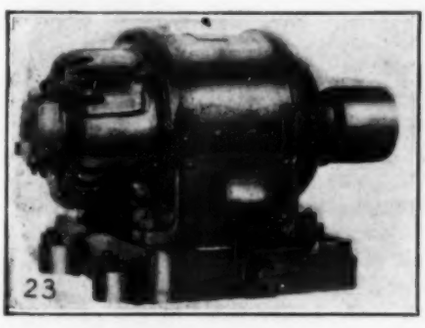
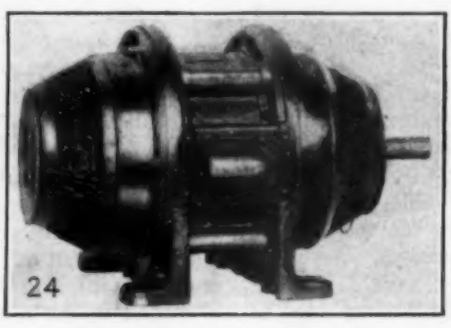


Fig. 22—Simplified ball-bearing construction





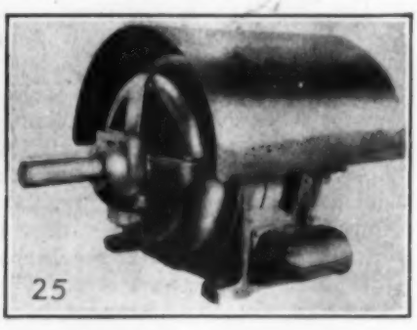


Fig. 23—Motor with cast-grid inclosure. Fig. 24—Screen covers
Fig. 25—Specially designed drip cover

times enables a motor to go into a space into which it would not otherwise fit. It also betters the general appearance of the motor.

Also, in the case of a squirrel-cage induction motor, which has a clearance of but a few thousandths of an inch between the rotor and stator, sleeve bearings will gradually wear until the rotor hits on the stator. Serious trouble, if not final destruction of the motor, results. This wear must be guarded against by periodically measuring the air gap with a gage furnished with the motor. With ball bearings there is very little chance of this occurrence as there will be no appreciable wear if the bearing is properly selected for the load, properly fitted, and protected from dirt. Trouble from overload will usually develop because of flaking of balls or races or cracking of one of the balls. This failure will be audible long before it is dangerous. Most ball and roller bearing troubles are caused by dirt. Fig. 22 shows how simple the ball bearing mounting may be.

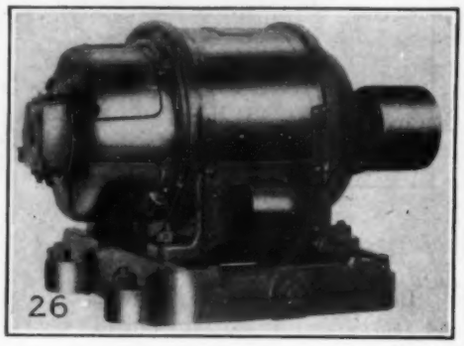
Where flexible couplings are used, it may be objectionable to have appreciable end play of the armature shaft. Ball bearings, as they are ordinarily installed, limit this movement. The inner race of the anti-friction bearing is first pressed on the shaft, and then held in place by a locknut, while the outer race usually has a push fit in the housing. It is possible to make this fit loose enough to get a certain amount of float, but nearly all ball bearing motors are made without any float whatever. This is an advantage in many instances, as in few, if in any, flexible couplings is there any provision for float of the motor shaft in the coupling.

Motors are usually classed as open, semi-inclosed, or inclosed. There are other classifications, such as the drip-proof, self-ventilated, and watertight motors which are not used so frequently.

The open motor is the one most generally used in an installation where the motor is not exposed to injury from fluids, chips, or other causes, as the motor will be better ventilated and will run cooler. Semi-inclosed motors usually have perforated or mesh sheet steel covers or cast metal covers in grid form. Fig. 23 shows a motor with cast grid-type covers, while Fig. 24 shows one having screen covers. They should be used where there is any possibility that chips or other objects may fall into the motors. It is believed that covers of one sort or another should be used much more extensively than at present as the appearance of a machine may often be improved by putting screen covers on the motor, and so rounding out its contour to conform with that of the machine.

Partial, or drip-proof covers inclose the top half of the motor with solid covers, and prevent water, oil or fine dirt from entering. They may use the upper half of a set of fully inclosing covers, or they may be of special design as shown in Fig. 25. They should be used where the motor is very close to the tool of the machine or where there is much chance of fine chips or dirt falling into the motor. They should also be used when a coolant attachment, bearing, or spindle, is apt to drop oil, water, or coolant compound into the motor. Oil, water or dirt in a motor will greatly increase the chance that a motor will give trouble. It is believed that a cover could be developed with louvres which would protect the motor from drip and allow a certain amount of ventilation through the cover as well.

In some cases it is advisable to completely enclose the motor, as is shown in Figs. 26 and 27. This construction should not be used, however, unless absolutely necessary, as it decreases the ventilation and consequently the motor rating. For motors with 5- or 10-minute ratings for traverse, hoist, or other very intermittent duty, this statement does not hold, and covers are advisable. If a motor lies idle in a shop for any length of time, dirt bearing a large percentage of powdered metal sifts in, and is apt to cause trouble when the motor is again started. It may even cause a flash over on the commutator, and is also likely to cause grounds and short circuits in the armature winding. For a motor with a very short time-rating, the real basis of rating is not the temperature rise, but the current that may be handled on the commutator without injurious sparking. Consequently, on traverse duty a motor can handle as large a load when completely inclosed as when open.



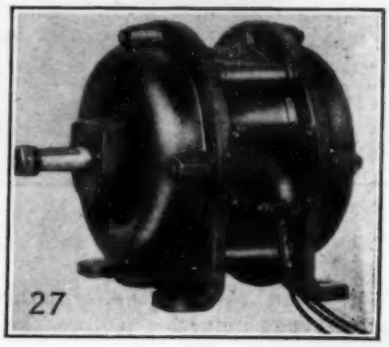


Fig. 26—Totally-inclosed motor. Fig. 27—Another type of totally-inclosed motor

Alternating-current squirrel-cage motors are usually well protected against chips or similar relatively large objects, and their contour is such that no covers are needed for appearance. However, covers are occasionally applied, as in the motor shown in Fig. 24. The covers in this particular instance were to protect the interior from lint in the air of a cotton mill.

Slip-ring induction motors are generally open over the slip rings. A cover is desirable when the motor is subject to oil drip, or the dropping of chips. Covers may also be desirable to improve its appearance when it is very conspicuous on a machine. Unfortunately drip-proof covers are not always standard with the motor builder, and it may be necessary for the machine builder to provide them.

All standard motors are provided with a single, straight shaft extension. At times they may have, as a special feature, an extension at either end. One part of the machine may be coupled to each end of the armature shaft to avoid a second cross shaft, or the shaft extension at the front end may be used for mounting a magnetic brake.

Tapered shaft extensions are used at times, particularly in steel mills, in order to make it easy to replace a complete motor. A pinion may be removed from a motor having a tapered shaft extension and mounted on a second motor much more easily than in the case of a motor with a standard straight shaft extension. The motor shown in Fig. 27 has such a tapered shaft extension.

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By FRED H. COLVIN
Editor, American Machinist

Lining up the steering knuckles—Fixtures for frame and spring assembly—Machine for running in brake bands and setting bands by a dummy brake drum

THERE are many details in the assembling of an automobile chassis, each maker having a few special operations that depend on the accessories and attachments that go on the car. One of the features of the Cleveland car is the use of the "one-shot" lubrication system for the chassis. The assembly of the front axles includes not only the tubing but the headers or distributing castings as seen in Fig. 1. The tubing carries oil from a plunger, or "gun" under the driver's foot to the steering knuckles as shown.

This view also shows how the axles are clamped at *A* and *B*, similar clamps being distributed along the assembly line at convenient intervals. These clamps hold the forgings firmly in position while the various parts are being put into place. After the steering knuckles are in place they are held in their proper alignment by the fixtures shown. The cross steering rods are put in place while the knuckles are held in position, the joints filled with grease from the box *C*, and the boot put over as at *D* to keep out the dirt. The springs are held in the blocks shown in Fig. 2, the axle is turned upside down over them and the spring shackles are put in place. The two blocks shown at *A* and *B* are for the two sizes of chassis.

In the meantime, the frame is being assembled from the side rails and cross members, in the fixture in Fig. 3. This view shows how the front horn is lined

The concluding article.

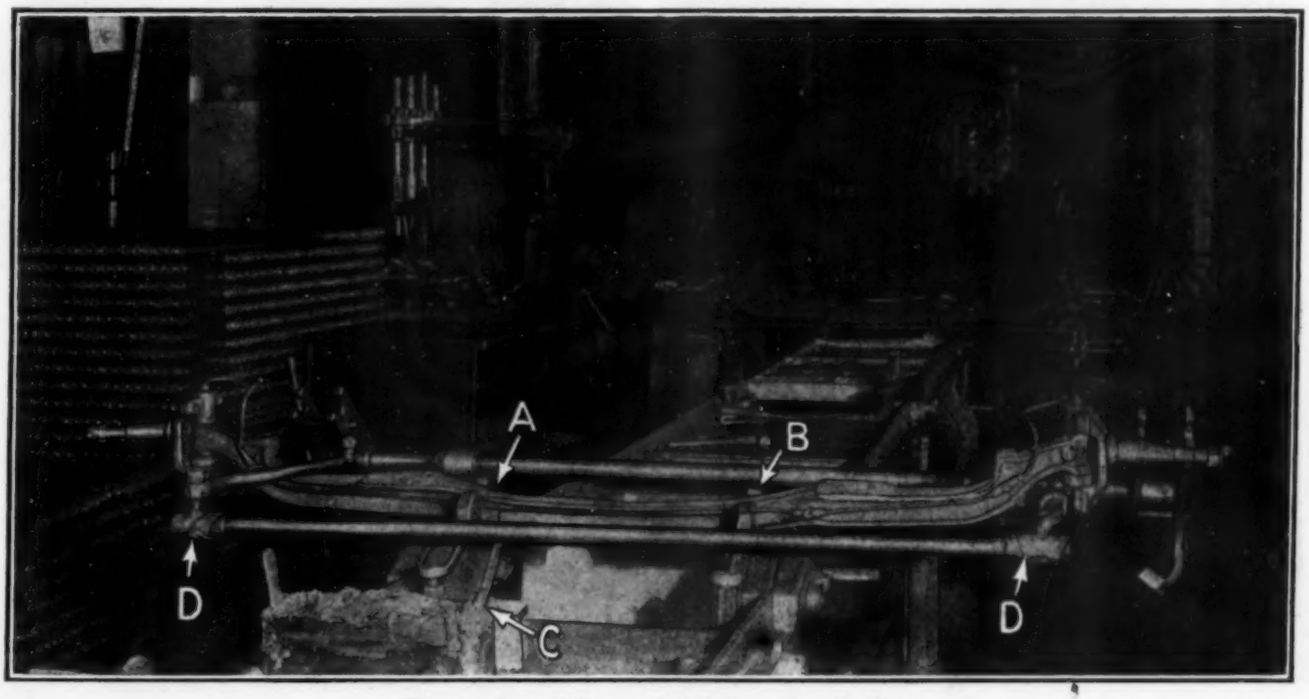
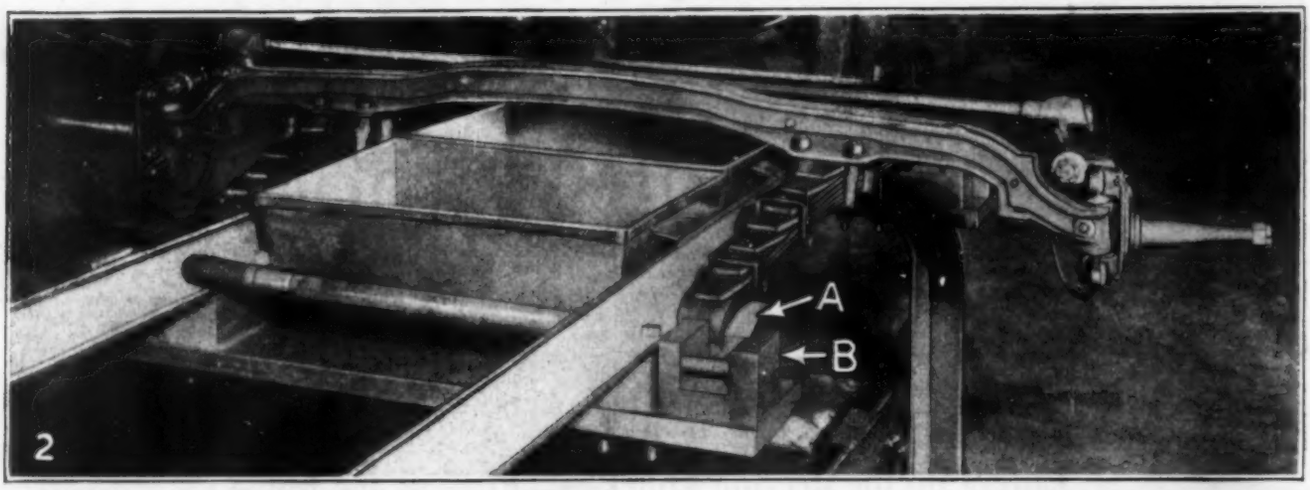
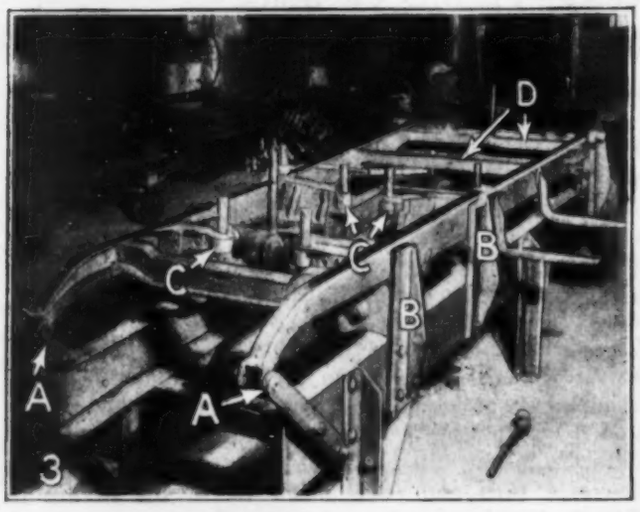
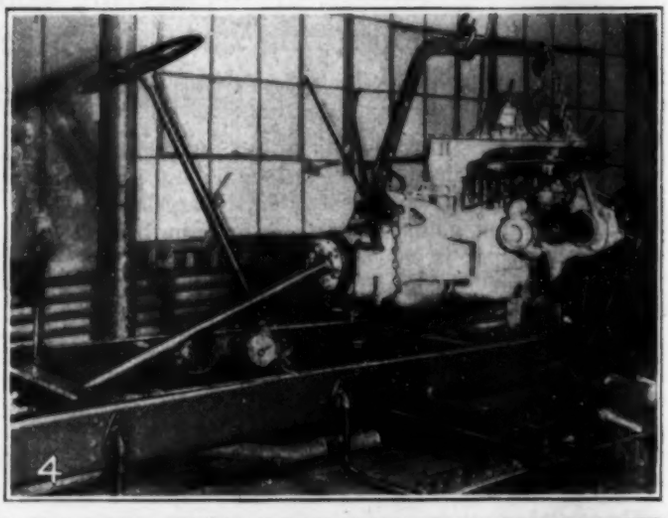


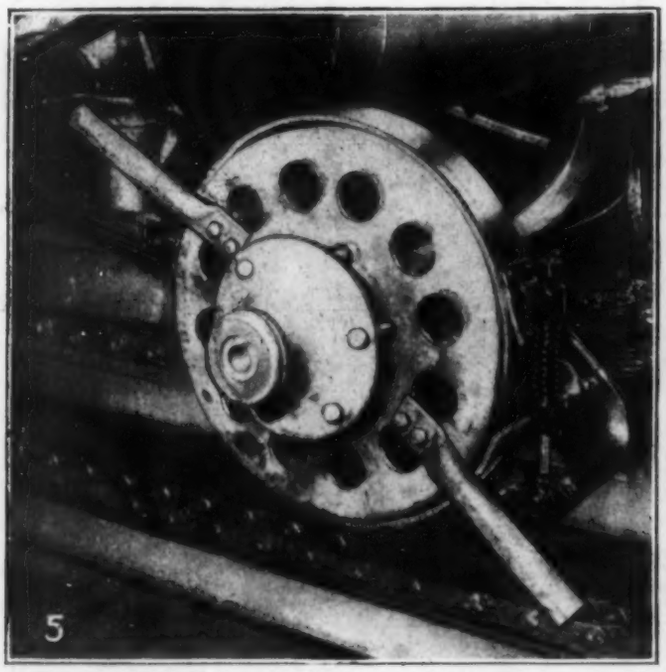
Fig. 1—Assembling and lining up front axles

Automotive Production









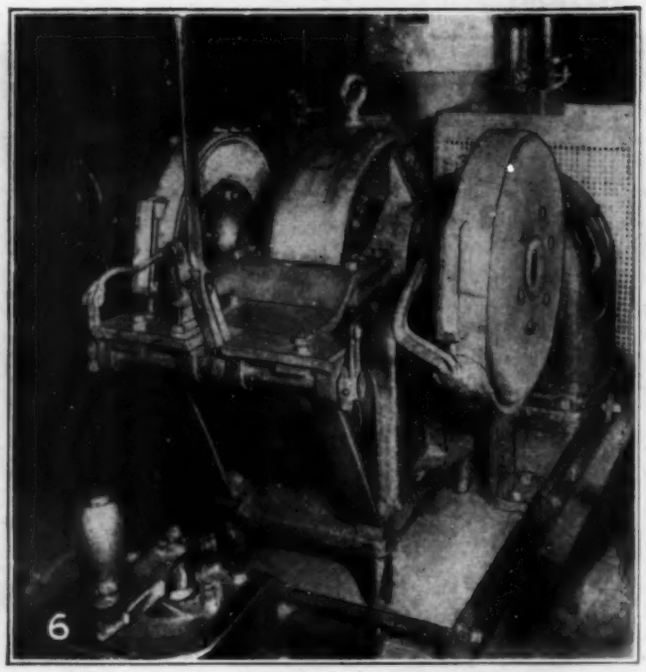


Fig. 2—Putting on front springs. Fig. 3—Fixture for assembling the frame. Fig. 4—Lowering engine into the frame. Fig. 5—Adjusting brakes on dummy brake drum. Fig. 6—Running in the brake bands

Automotive Production

up at *A*. The side rails are clamped against the supports *B* by the cam-operated clamps *C* to secure the proper spacing for introducing the cross-members *D*. The side rails are also positioned and the step brackets are riveted in place. The general design and construction of the fixture can readily be seen by a study of this view.

With both axles on the frame, it is turned over and goes on the assembly chain as in Fig. 4, where the engine with the propeller shaft attached is being lowered into the frame. The steering post and bracket are already in place. This view shows how the engine is lifted by the sling. The generator, carburetor, water pump, exhaust manifold and distributor are in place.

In fitting and adjusting the brake bands, a dummy brake drum is used as in Fig. 5. The dummy is a counterpart of the drum in the wheel and the brakes can be adjusted to it without difficulty. The brakes have been previously run in on the machine shown in Fig. 6. It consists of a worm-gear reduction made by the Boston Gear Works and is motor driven, the speed being regulated by the controller in the foreground. The gear shaft carries a brake drum on each end, and the brake linkages in front allow the bands to be contracted as desired. The object of the run is to wear the fuzz off of the fabric and get the bands bedded down so that the setting done in assembly will not quire readjustment soon after the car goes into service.

Fundamentals of Automotive Service

By T. L. Preble

MORE than 20,000,000 motor vehicles are registered in the United States, comprising 81 per cent of the entire registration of the world. The tremendous task of servicing these vehicles is divided amongst about 48,000 service stations maintained by car dealers, and 31,000 independent service stations, a total of over 79,000 repair shops not including those maintained by owners. More than 480,000 repair shop employees are necessary for mechanical repairs. Automotive service is, therefore, an industry of considerable proportions.

Careful analysis preceding delivery of the new unit should be made jointly by buyer and seller, in order that the vehicle best adapted to the exact uses for which it is intended may be delivered. Inadequate knowledge on the part of owners, and indifference on the part of the sellers, have been the cause of much waste in the past. Analysis should include the determination of average and of worst operating conditions, and application to such conditions of units adequately powered, and equipped with the gear ratios necessary to handle the worst conditions.

Another factor of importance in servicing is found in the desirability of a reasonable interchange of parts and units on various models. Furthermore an engineering policy of designing new parts and units interchangeable with old results in benefits to the owner which are obvious. But the final measure of service is that of experience. The purchaser who neglects to make a thorough examination of the experience of others is omitting the most important factor of all.

It may be stated briefly that the functions of mechanical repair work are the rendering of quick work, well done, and at a cost as low as adherence to highest quality will permit, thus insuring a minimum of idle vehicle hours and maintenance expense. In carrying out this objective the automotive industry is confronted by a problem which is now receiving the study that for many years was chiefly reserved for production. The two problems, in fact, have much in common.

Standardization of repair service permits a more efficient control of job delivery promises, of quality, of waste, and of cost to the owner. It results in better material control and in ability to requisition parts, tools and materials in advance of workmen's needs. It eliminates excessive lost motion. Its ultimate development permits the payment of higher wages because of lower costs, and assists in attaining steadier and more assured volume of repair business. It should be possible through proper standardization to pre-requisition more than 85 per cent of all items necessary, the result naturally being that of reducing mechanic idle time.

With reference to waste, the setting up of proper standards results in reducing to a minimum the needless renewal of parts, proper salvage standards clearly indicating whether old parts should be utilized or scrapped. Loss due to spoilage and breakage is similarly reduced to a minimum.

There are four methods of dealing with customers with regard to cost: The ordinary one of charging in accordance with actual time and material consumed; the approximate estimate; the maximum estimate; and the so-called flat rate or fixed price. The latter two methods are preferable in that they give the owner a definite quotation in advance.

Rapid strides are being made in tool development, though many repair shops are still sadly deficient. Some instances may be observed, on the other hand, of shops, particularly those of fleet owners, which are over-tooled, having items of expensive and very little used equipment adding needlessly to the owner's overhead expense.

Another problem confronting the repair shop results from the violent fluctuation of business to which shops, large and small, are subjected. These fluctuations make more difficult the attainment of the ultimate goal of every repair shop, a complete production basis. This burden, particularly difficult for the smaller shop, is made easier by the provision of "fill-in" work such as used-car repairs, and by such control and scheduling of incoming work as can be exercised.

The increasingly important stress being placed by owners of commercial vehicles upon continuous service, and upon the necessity for reduction of vehicle inven-

Extract from a paper presented at a meeting of the Metropolitan Section, S.A.E., New York, Dec. 16, 1926.

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tory by increase of vehicle hours, is being met by night service and by unit replacement.

Organized night service, a difficult problem, but one which can be solved successfully, carries an advantage to the repair shop as well as to the customer in that it permits a more continuous use of building and equipment, involving, where any considerable volume can be maintained, a worth while reduction in overhead expense.

Unit replacement, where the actual repair of the unit involved consumes more time than is taken by a mere exchange of a rebuilt unit for the worn unit, is bound to lessen the total time of the vehicle spent in the shop. It is obvious that if the repair of a certain unit on a vehicle can be accomplished by the simple process of installing a completely rebuilt unit, billing the owner only for the repairs of the unit he turns in, he has been benefited by the increased productive time thereby secured for his truck.

It is recognized by service managers that a repair shop has also a business function, that of creating good will, of lessening sales resistance, and of producing at the same time a satisfactory profit and loss statement. There exists the necessity of training service men in personality and courtesy, and of instructing them in the maintenance and operating problems confronting owners, in order that they may cope with the broader aspects of their job.

Such owner contact, properly organized in a genuine spirit of helpfulness, results in added good will. It is a form of sales engineering. Such contact is of great assistance to the repair shop in maintaining a high volume of business. Organized personnel contact, backed up by a proper analysis of what may be termed the repair market, enables the service manager to feel the pulse of the customer, and properly developed owner contact permits the repair shop to check its efficiency by detailed customer complaint analysis.

Why Discard The V Thread?

By E. C. Herb

A SHORT time ago I was called upon to build a small high-speed machine, in one part of which a headless setscrew was used, ¼ in. in dia., ¾ in. long. Should this screw become loosened while the machine was in operation some undesirable things would happen, so it was necessary that the screw be a snug fit in the hole.

I soon discovered that all the taps were from 0.004 to 0.006 in. oversize, and all the screws were the same amount undersize, so the fit was like the boy's new suit after he had been caught in the rain.

Attention was then turned to the finer threads of the S.A.E. variety, the thought being to cut the heads off of the regular screws, but it was found that the same amount of air would circulate between these screws and the tapped holes.

A frantic search all over town finally uncovered a ¼-in. 20 V-thread tap, that had been in stock fully 20 years. After tapping several holes in dry cast iron to remove any burr from the tap, the hole in the machine part was tapped, and then the U. S. S. screw was a perfect fit. There the much abused V-thread had its place.

Seen and Heard

By John R. Godfrey

Is a smooth cylinder wall desirable?

THE subject of cylinder bores—or more properly of the surface that produces the best results—is still open to discussion and difference of opinion by the best minds. It was claimed long ago that the best boring and reaming could not equal the ground surface for a cylinder bore. Not only was the ground surface found smoother than reaming, but the hole was supposed to be more nearly round.

There are skeptics who scoff at the idea of trying to get a bore exactly round in a long cylinder block, because of the distortion that is bound to occur when the cylinder gets heated up in operation. But we keep on grinding them just the same.

Then we have the honing, which is in reality more of a grinding operation than of lapping, and find that it is being used by many makers of engines. A few makers hone the cylinder after grinding.

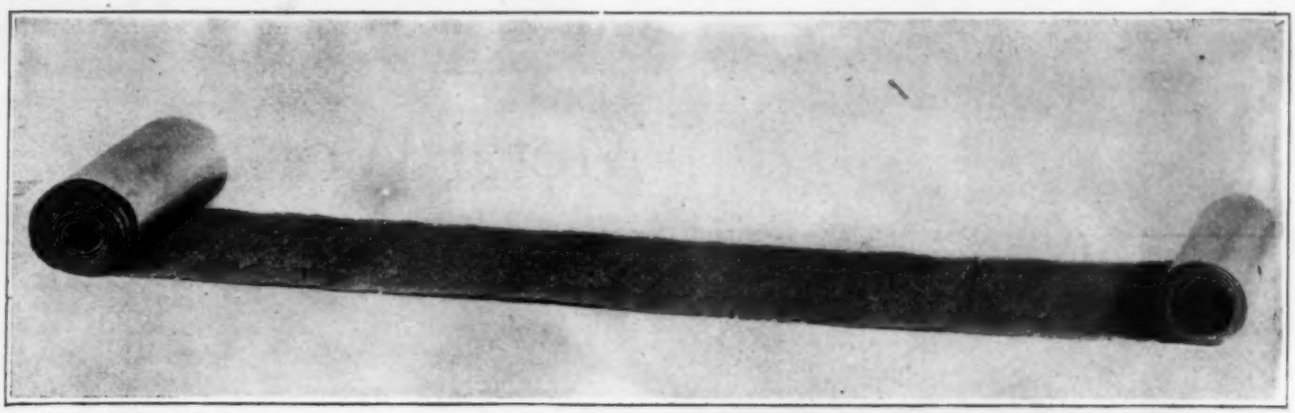
If we feel of the surface of a nicely ground cylinder, it seems to be almost perfection. Yet we can see hundreds of "hills and hollows" in the surface, even without a magnifying glass. Honing removes most of them, since the depressions are very shallow, frequently less than a thousandth of an inch.

There seems to be no question as to honing being able to produce a very smooth cylinder bore. But there seems to be a question as to how smooth the cylinder wall should be to give best results.

The usual belief seems to be that the smoother it is the less "wearing-in" is necessary to secure maximum tightness and the highest compression. This view, in the mind of one of the best airplane-engine designers and builders, overlooks the fact that unless the piston ring and the bore of the cylinder fit each other, the smoothness of the cylinder bore is comparatively unimportant. He contends that the piston rings will wear in to a good fit much more rapidly if the cylinder is not too smooth. In other words, that it is better to omit the honing operation and to leave the cylinders as they come from the grinder. He finds that the ground surface will wear the rings to a good bearing much more quickly than where the cylinder bore is lapped or honed.

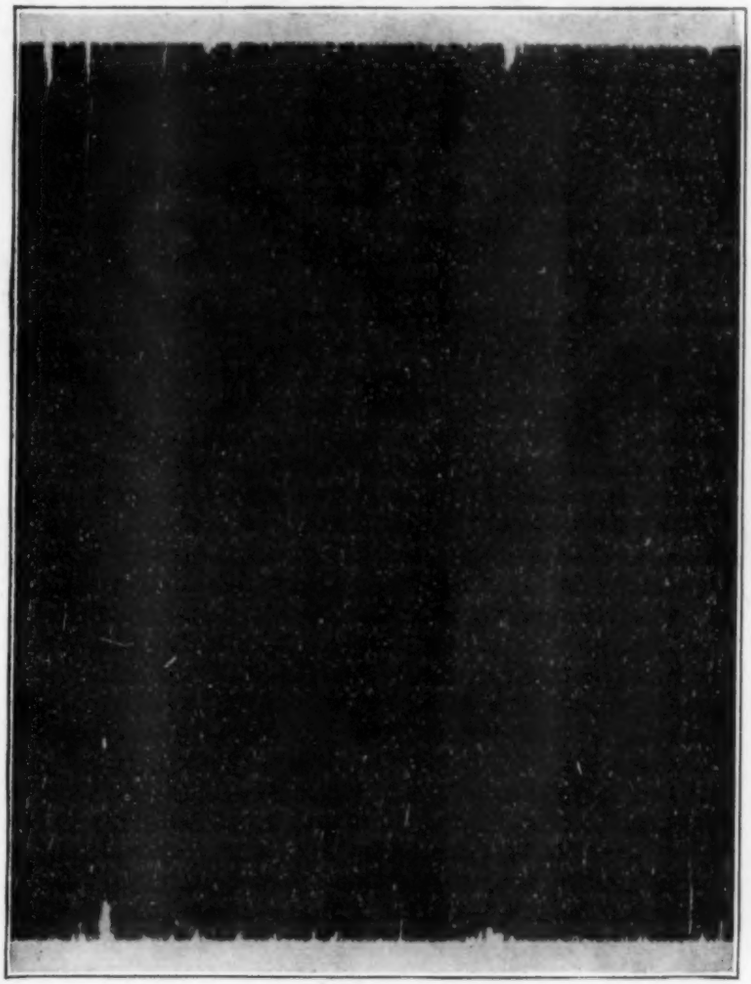
It is a far cry from the airplane engine that develops 50 hp. in a single small cylinder, to the old, slow moving Corliss steam engine where a 50 hp. engine occupied a good-sized engine room. The generation of power has changed in many ways since then. But I am reminded of an old chief engineer who held the same view regarding the cylinders of his Corliss engines.

Whenever he ordered a new engine, he specified that the finishing cut in the cylinder be omitted, and that the bore be left with the roughing cut. He contended, as did the airplane engine builder mentioned, that the rings wore in better and fighter if the cylinder was not too smooth when new.

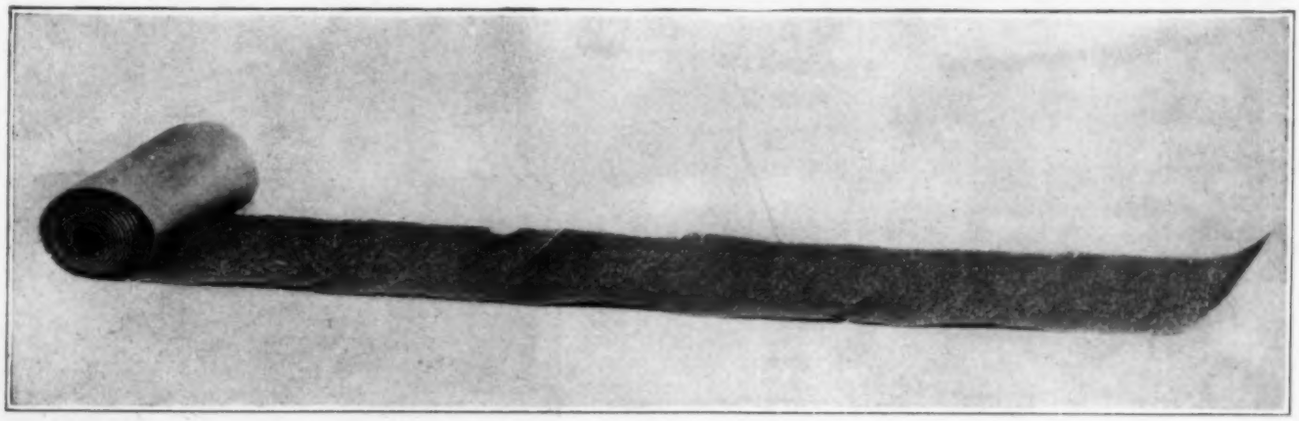


A 5-in. x 10-ft. Cast-Iron Chip

The kind of a chip that can be rolled up from good cast iron with a wide finishing tool, correctly ground, and held in a capable planer



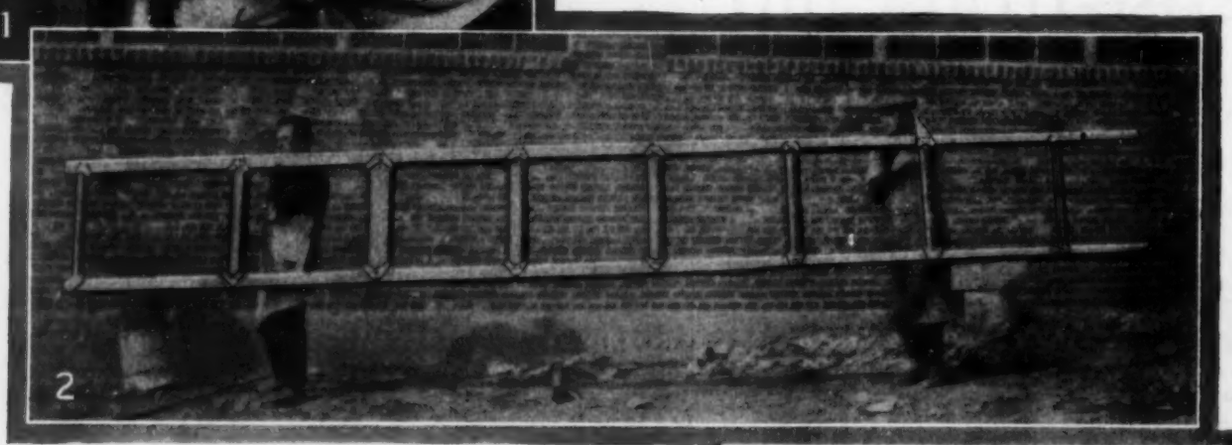
The chip illustrated is 5 in. wide and was about 10 ft. long as it left the tool

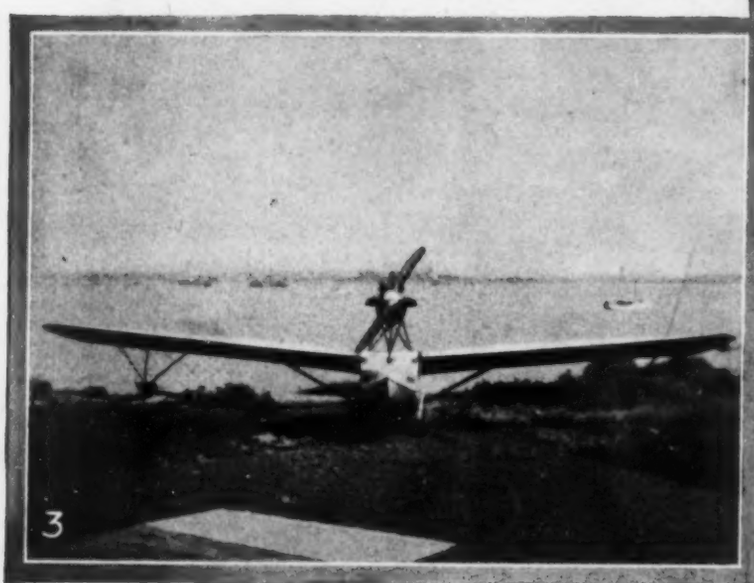


Metal Work on Small Flying Boat

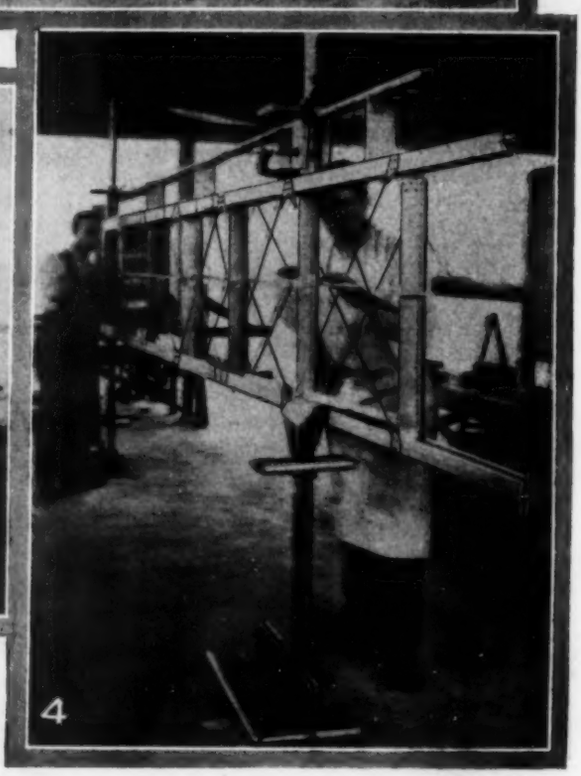
1—Riveting wing spar on Chapman press, using special dies

2—Metal frame of wing





3—Completed boat



4—Bracing the wing spars

5—Hull upside down in jig

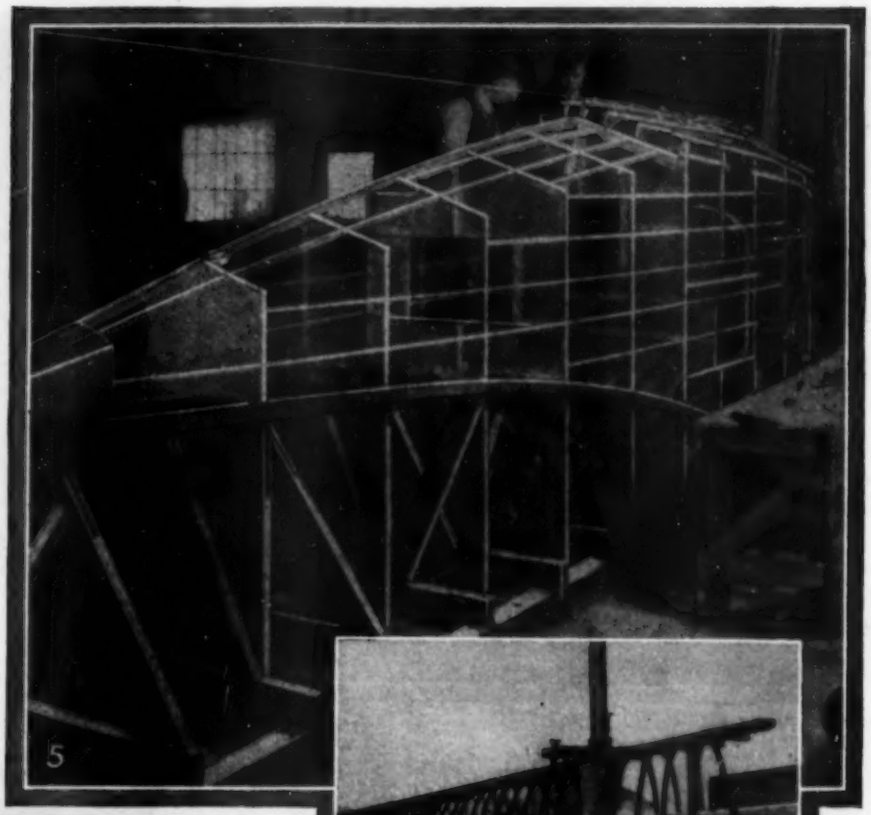
6—Hull nearly completed

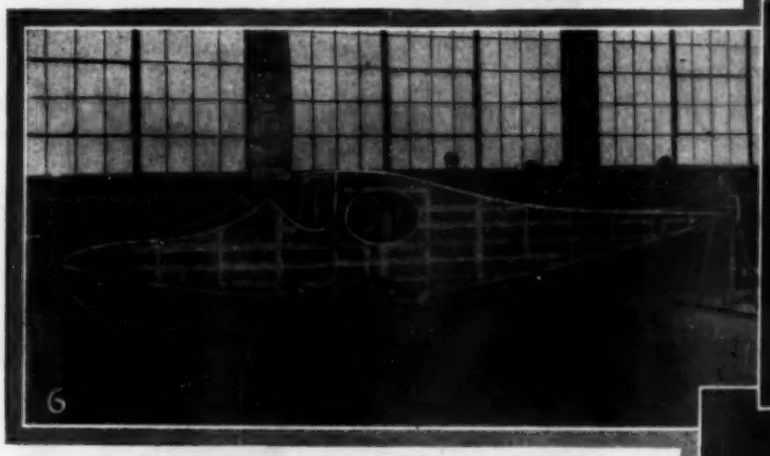
7—Putting wing ribs in place

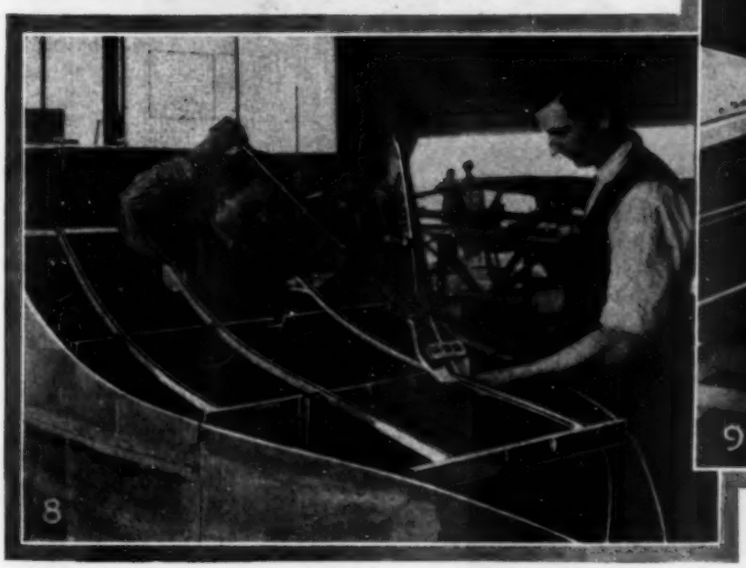
8—Squeeze riveting with Porter bolt cutter and special dies

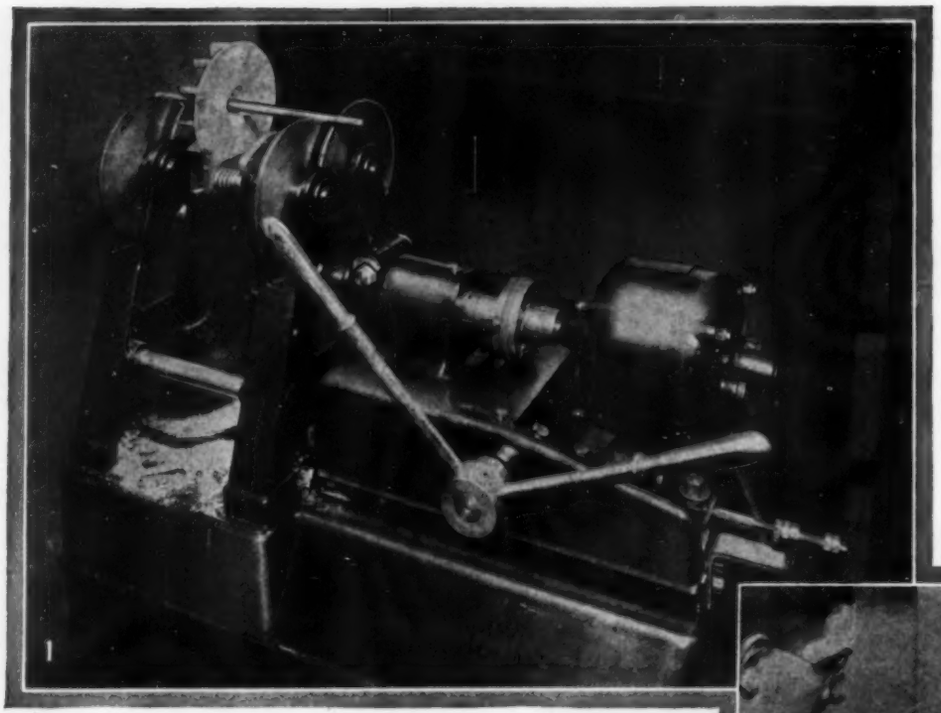
9—Riveting duralumin sheets with Whitney ball bearings punch and special dies

Photographs by courtesy of the Edo Aircraft Corporation, College Point, L. I., N. Y.





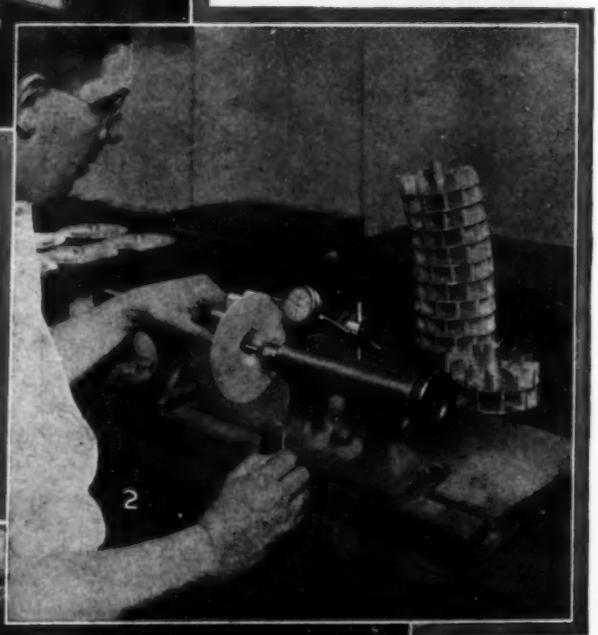




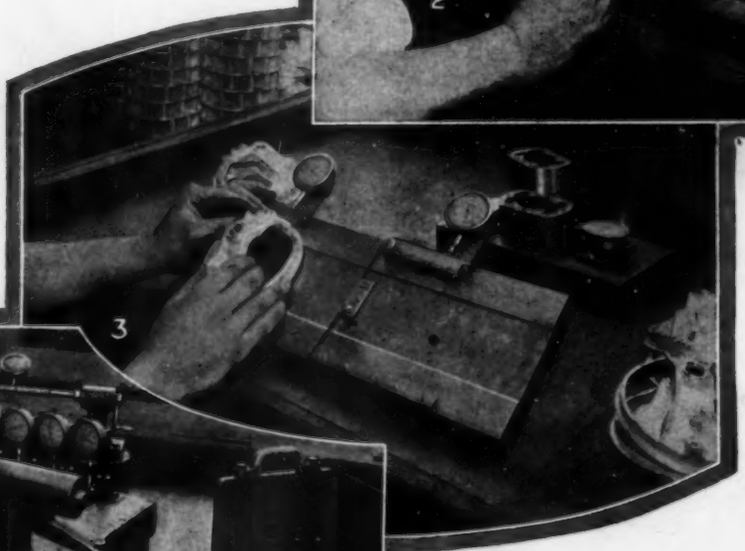
1—Balancing fan rotors, or disks, and milling out weight on heavy side of disk

Photographs by courtesy of the Hoover Sweeper Co., North Canton, Ohio

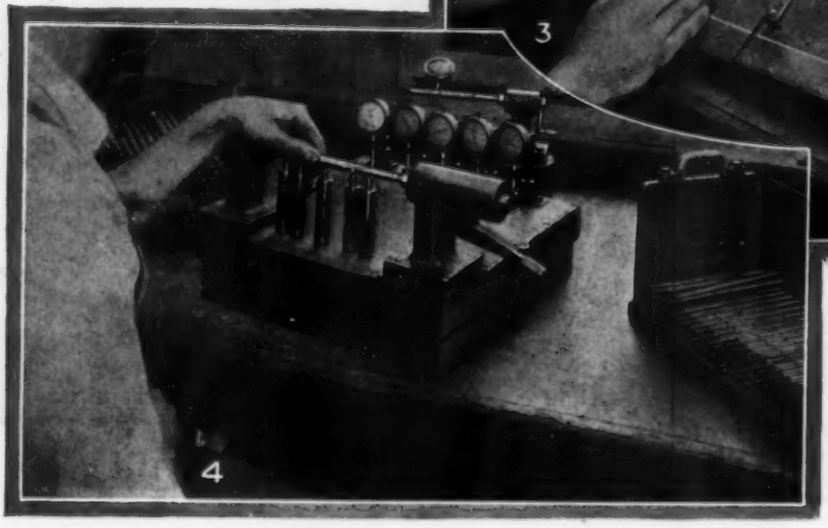
Inspecting Vacuum Cleaner Parts



2—Testing fan disks for "wabble"



3—Dial "go" and "no go" gages for flange diameter



4—Gaging five shaft diameters at once

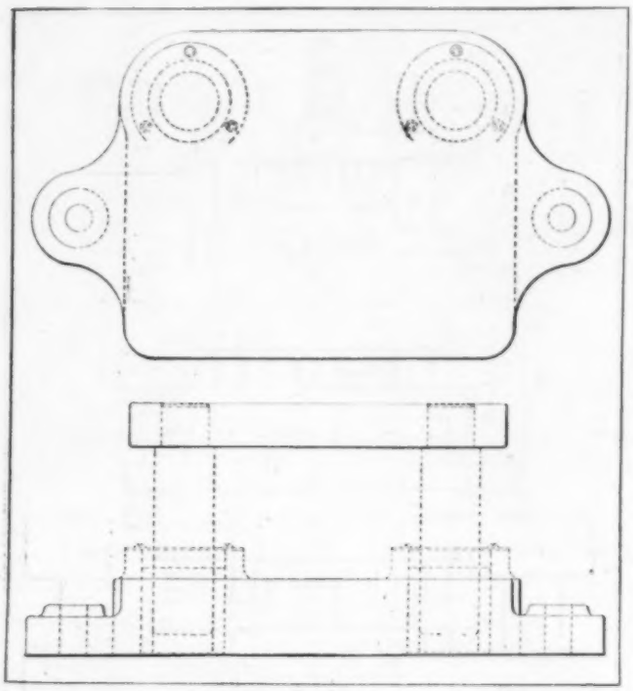


Fig. 1—Standard die assembly printed on tracing paper

Standardized Practice Simplifies Die Design

By FRANK W. CURTIS
Western Editor, American Machinist

Elimination of waste is made possible by standardizing the construction of die shoes, punch holders, die blocks, wire punches, button dies, spring pins, and compound-die proportions

DESIGNING a compound blanking and piercing die for a 12-tooth pinion, 125 in. thick, with 1-in. pitch diameter, and having a ½-in. hub hole and four ⅛-in. rivet holes, would be considered a difficult task in many shops, but at the plant of the National Cash Register Co., Dayton, Ohio, such design is considered an everyday event. In some shops, two days or more would be required to make the layout, whereas at the N.C.R. plant a half-day is considered ample time. Standardization, based on the results obtained from experience, makes possible substantial economies of this kind, and has eliminated the greater portion of the guesswork that usually exists in die construction. By no means is each job a replica of a former job. New die problems are received daily. The fundamental principle followed is to standardize die parts wherever possible and thereby avoid waste.

About half of the parts that comprise a cash register are made of sheet metal, and for the different models that are manufactured there are employed approximately 60,000 active dies. Die-shoe assemblies are prominent in this group and their standardization has simplified both die designing and die construction. Six of the most frequently used assemblies are printed on tracing paper as shown in Fig. 1. When a press tool applicable to one of these standards is to be drawn, the designer obtains a printed sheet, mounts it on the drafting board, traces the component on the sheet from the part blue print, and lays out the constructional details to suit. The die-shoe assemblies are made in stock quantities so that the diemaker's work is confined merely to the detailed parts required. In Fig. 2 are illustrated details of the die-shoe assembly designated as No. 2 by the designers.

Other styles of die shoes and punch holders that are considered standard are shown in Fig. 3. At *A* is shown a two-pin type that is made in lengths from 13 to 32 in., widths from 6½ to 10⅝ in., and center dis-

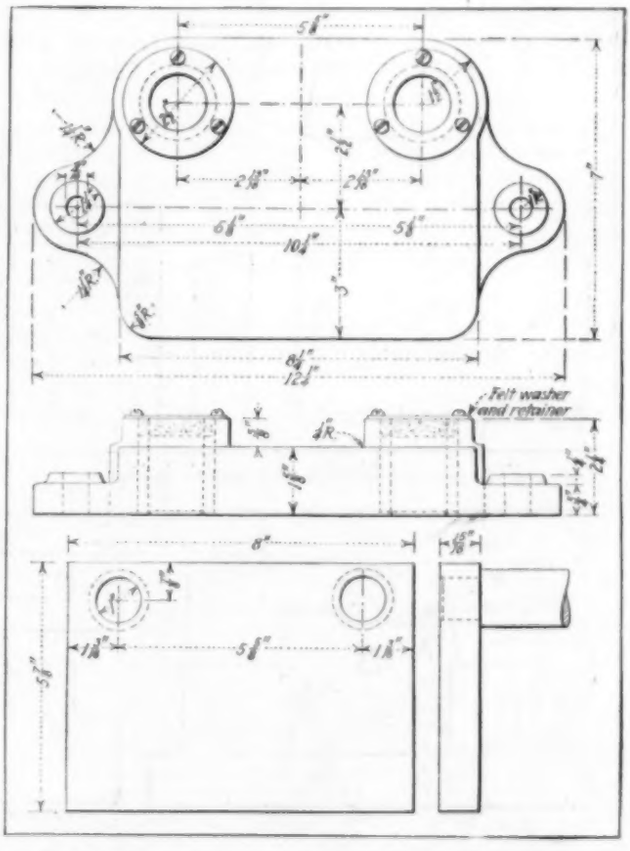


Fig. 2—Constructional details of a die-shoe assembly

First part. The conclusion will be published in an early issue.

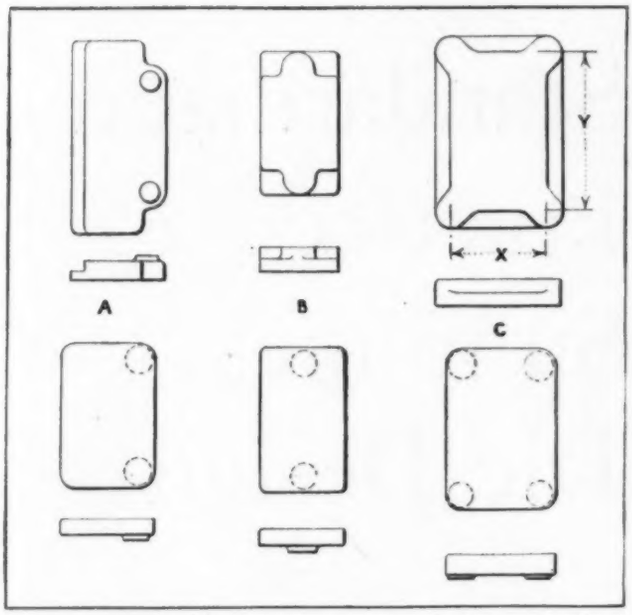
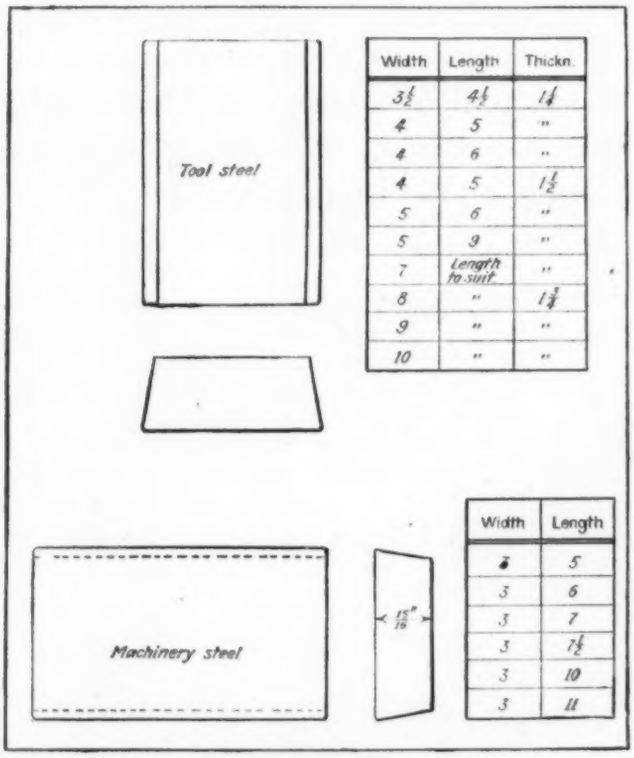


Fig. 3—Standard types of die shoes and punch holders



Width	Length	Thickn.
3½	4½	1¼
4	5	"
4	6	"
4	5	1½
5	6	"
5	9	"
7	Length to suit	"
8	"	1¾
9	"	"
10	"	"

Width	Length
3	5
3	6
3	7
3	7½
3	10
3	11

Fig. 4—Die blanks and punch holders

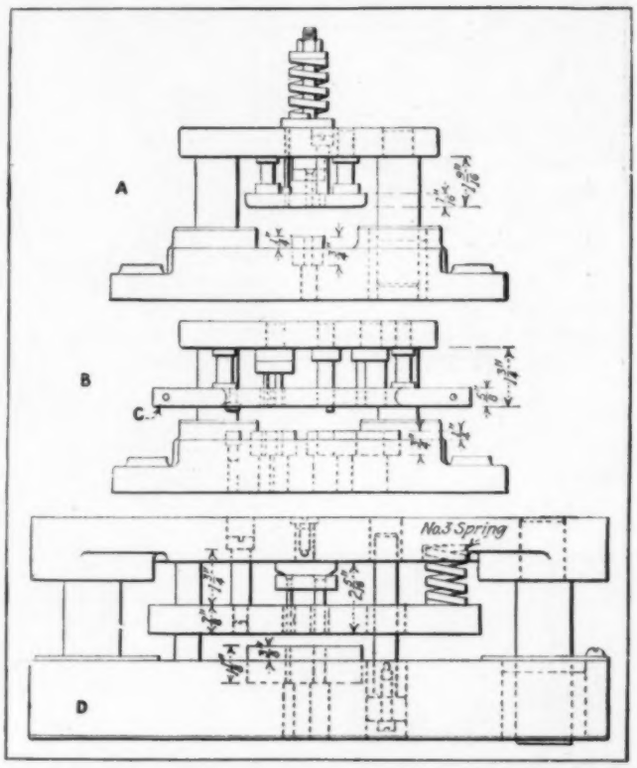


Fig. 7—Practice followed in constructing piercing dies

tances between pins from 9 to 18½ in. The two-pin type shown at *B* is made in widths from 6 to 14 in., and center distances between pins from 8 to 38 in. For larger work, where a four-pin die is required, the design shown at *C* is used. The distance *X* varies from 8 to 35 in. and the distance *Y* from 9 to 44 in. Only the patterns for these designs are carried in stock.

Die blanks and punch holders for blanking and progressive dies are made in standard sizes as shown in Fig. 4. For medium-sized work, and in cases where the blank requires shaving, guide-pin dies, such as illustrated at *A*, Fig. 5, are used. The guide pins are fastened in the die shoe, and the punch holder, made of cast iron, has guide-pin holes to correspond. Bushings, such as shown in the die assembly in Figs. 1 and 2, are not used. Sheet-metal safety guards surround the guide pins as shown. Blanking dies used in making steel cabinet work and large work are made as outlined at *B*. The dimension X is held to 6¾ in. maximum when the die is in a closed position.

Forming dies also are standardized, four sizes being used. At *A*, Fig. 6, is shown an open forming die

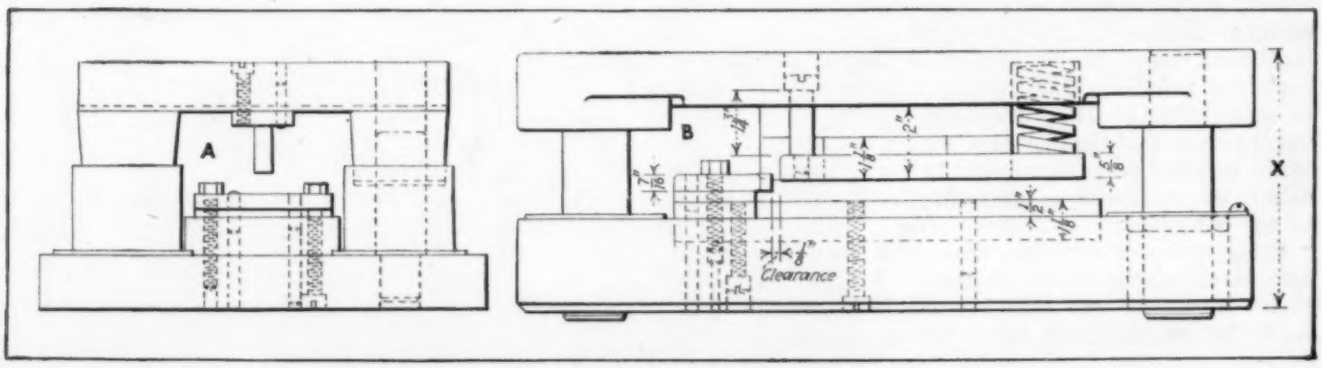


Fig. 5—Blanking dies for work that requires shaving and for large parts

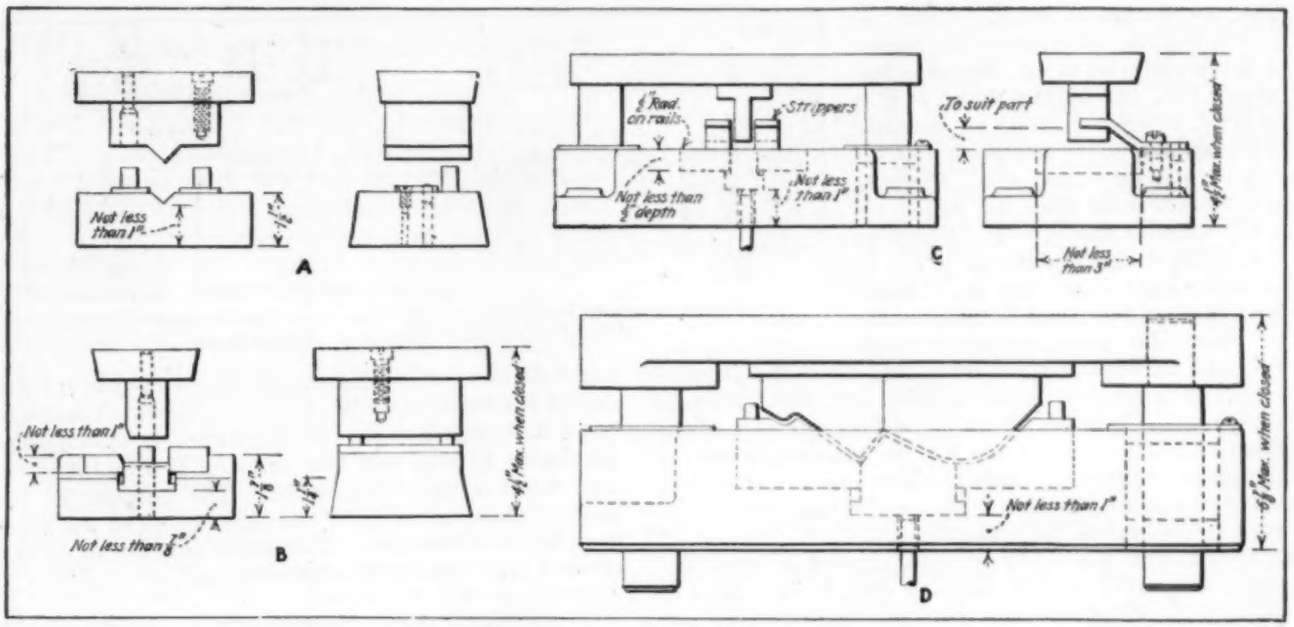


Fig. 6—Four standard types of forming dies

utilized in making small parts that do not require extreme accuracy. The die block and the punch holder are standard blanking die units. Small work that cannot be formed properly on this form of die is made by the type shown at *B*. The die shoe is made of machinery steel to the dimensions outlined. A guide-pin forming die, such as shown at *C*, is used for parts that must be formed accurately and yet are too large to be formed in the die illustrated at *B*. At *D* is shown the type of forming die used in producing large work such as steel cabinet parts. The die shoe shown at *B*, Fig. 3, is used for examples *C* and *D*. The most commonly used sizes are carried in stock.

In Fig. 7 are illustrated standard piercing-die designs. At *A* is shown a top-spring piercing die that is applied to small parts. The cam-stripper die at *B* is used in making medium-sized parts. The stripper *C* is attached to a cam on the crank of the press and in operation it strikes the work before the press ram descends. On the upward stroke, the stripper is held against the work until the punches have been withdrawn, thereby offering a positive stripping action. At *D* is shown the larger type of piercing die utilized in piercing and notching cabinet parts. A maximum height of 6¾ in., when the die is in a closed position, is maintained.

In addition to the standardization of die shoes, punch holders, and their component parts, general constructional details, also, are based on standardization practice. Round punches and those having similar outlines are fastened to the punch holder as shown at *A*, Fig. 8. A tennon, machined in the upper portion of the punch, is pressed into the punch holder and is secured by a tapered dowel pin. When the punch is irregular or rectangular in shape, it is held in place by screws and dowels as shown at *B*. Small wire punches and their holders are mounted as shown at *C*. Larger sizes are

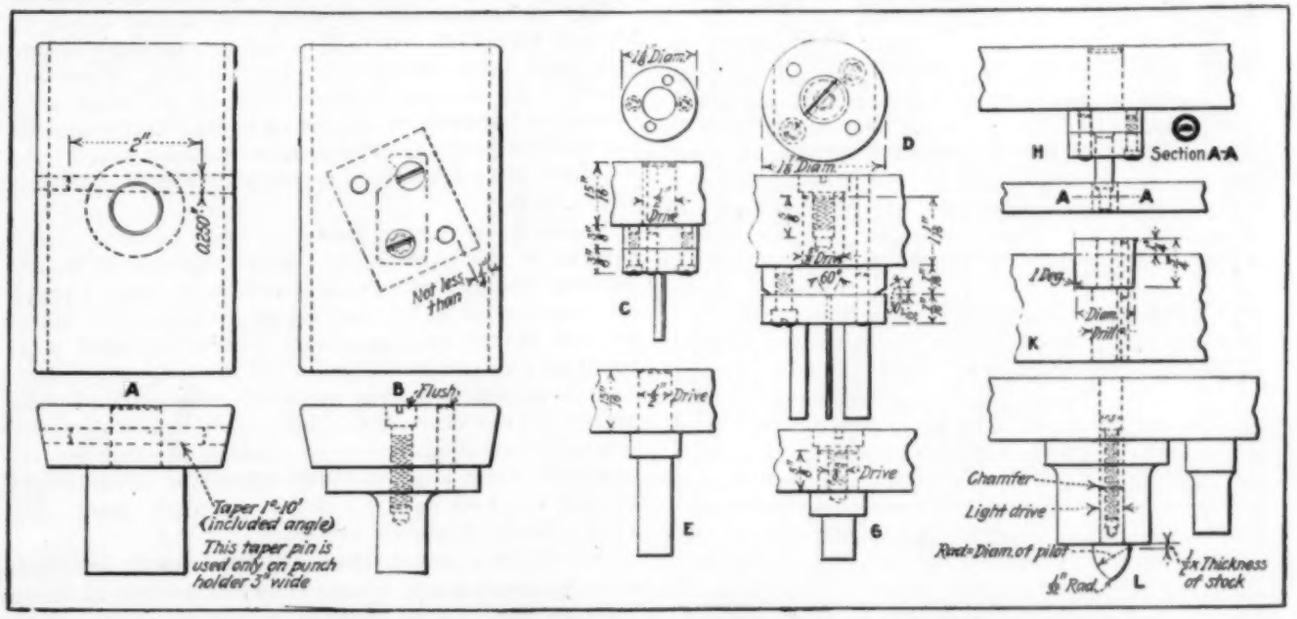


Fig. 8—Standard designs for punches, die buttons and pilots

held as illustrated at *D*. When the punch is $\frac{3}{8}$ in. in diameter or larger, and the material to be pierced is less than 0.1 in., the method shown at *E* is utilized, whereas punches of the same size, used for material thicker than 0.1 in., are made as shown at *G*. Piercing punches for small holes, not round, are constructed as shown at *H*. Standard button-die design is outlined at *K*. In piercing small work, the die is made $\frac{3}{4}$ in. high and projects $\frac{1}{4}$ in. above the die shoe; for larger parts the die is made $1\frac{1}{4}$ in. high and projects $\frac{3}{8}$ in. above the die-shoe face. Pilots for progressive dies are constructed as shown at *L*. In cases where more than one pilot of the same diameter are used in a die, the shank diameters of the pilots are made to different diameters so that they will be replaced properly after the die has been sharpened or dismantled for repairs.

A standard type of spring pin, carried in stock and used for nesting work in piercing dies, is illustrated at *A*, Fig. 9. Four sizes are stocked, ranging from $\frac{1}{4}$ to $\frac{3}{8}$ in. in diameter and from $1\frac{3}{4}$ to $2\frac{3}{4}$ in. in length. When this style cannot be used, the designs shown at *B* and *C* are applied. At *D* is shown a removable type of spring pin used in dies that accommodate several sizes of work.

In compound-die practice, the punch and die lie in a reverse position as compared to a plain blanking die. The punch lies beneath the die and forces the blank into the die. Care should be taken in laying out a compound die for irregularly shaped pieces in that the flat side of the blank must be shown face down. Constructional details of a compound blanking and piercing die are shown in Fig. 10. The drawing is comprehensive and requires little description. The purpose of the push-off pin is to eject the completed blank in the event it sticks to the shedder. Compound dies for all classes of work carry the specifications outlined.

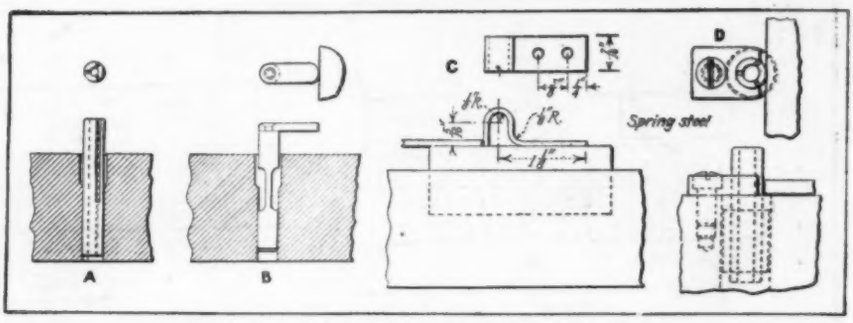


Fig. 9—Different types of spring pins

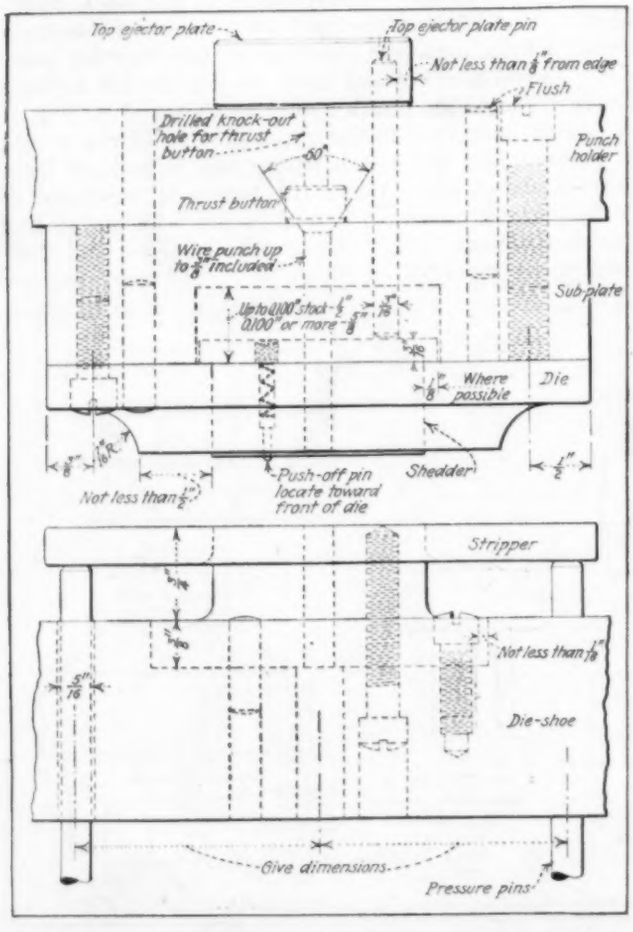


Fig. 10—Constructional details of a compound die

Tap Sizes and Center Distances

BY EDWARD D. FRANK

WHY is it necessary to have so many drill and tap sizes? Why not eliminate all the tap sizes running in sixteenths of an inch?

It is suggested that where a $\frac{5}{16}$-in. tap is now used, it be replaced with $\frac{3}{8}$ in., replace $\frac{7}{16}$ in. with $\frac{1}{2}$ in., replace $\frac{9}{16}$ in. with $\frac{5}{8}$ in. and so on. By so doing, quite a saving will be made in the stocks carried both in drills and taps. Frequently a casting that is tapped from three sides, will have $\frac{1}{4}$-in. holes on one side, $\frac{5}{16}$-in. holes on another and $\frac{3}{8}$-in. holes on the third side. This calls for three different sized taps when one size only would have been necessary. It is probable that $\frac{3}{8}$ in. would have answered as well for all three sides.

Assuming that present designs will have to remain as they are, it seems that consideration might be given this subject for future designs by engineering departments.

Why is it necessary to have close center distances between holes? It seems that engineering departments give very little thought to this subject. Holes are spaced $\frac{3}{8}$ in. between centers when $1\frac{1}{2}$ in. would have worked no hardship on the design or the effectiveness of the finished product. The greater distance would have a decided advantage when considered from a viewpoint of the shop.

Standard, or master, bushings could be used in the fixtures in the latter case. Where multiple drills are involved, spindles and thrust bearings of heavy enough construction could be used, so as to reduce the maintenance charge to a minimum. Small spindles, as a result of close center distances, call for frequent repairs. Two operations are often necessary on account of close centers. Then there is the additional item of carrying several different diameters of spindles in stock for repairs. I would suggest that engineering departments be instructed to have no center distances closer than $1\frac{1}{2}$ in., unless absolutely necessary.

One of the greatest abuses is where dowels are used, since they will nearly always be placed as close to screw holes as they can be crowded regardless of the effect on manufacturing cost.

Profit Ideals—More Discussion

BY GEORGE H. YOUNG
Manager, The Photogenic Machine Co., Youngstown, Ohio

IN LINE with the suggestion of my good friend Norman Gould, on page 483, Vol. 65, it might not be amiss to add an opinion, based on a number of years' experience as an industrial engineer, that the matter of overhead expense is overlooked more often than we realize because it is not fully understood.

As a possible help to some of your readers, who may not have their yearly results shown in quite as convenient form as Mr. Gould's it might be a help to present a typical manufacturing statement that would seem to fit a good many of the smaller industries.

It makes very little difference whether the products manufactured are paper bags or battleships—the form could be about the same. If each interested manager will distribute all of his income and expense figures, for six months or a year, into one or the other of the items shown, substituting his own figures in this statement, it may give him an idea of what he has accomplished.

Operating Statement
Jan. 1 to July 30

INCOME			
Sales: Regular products	$32,187.00		
Miscellaneous	614.00		
Total Sales	$32,801.00		
Less discount allowed	472.00		
Net Sales	$32,329.00		
Discount earned	187.00		
Other income	224.00		
Total net income			$32,740.00
EXPENSE			
Inventory, Jan. 1	$7,640.00		
Materials purchased Jan. to June	5,593.00		
Labor and supervision Jan. to June	13,254.00		
Total		$26,487.00	
Less inventory, June 30		6,957.00	
Total material and labor (used in products sold)			19,530.00
Gross manufacturing profit			$13,210.00
Manufacturing Expense			
Freight and cartage	$534.00		
Light, heat, power and water	292.00		
Postage	237.00		
Expressage	72.00		
Telephone and telegraph	146.00		
Office printing and supplies	271.00		
Patterns	488.00		
Small tools and repairs	218.00		
Total		$2,258.00	
General Expense			
Rent	$420.00		
Taxes	215.00		
Insurance	175.00		
Legal and patents	188.00		
Depreciation	378.00		
Office salaries	1,680.00		
Miscellaneous	114.00		
Total		3,170.00	
Selling Expense			
Traveling	$336.00		
Bad debts and collections	37.00		
Subscriptions and dues	154.00		
Advertising	2,115.00		
Salaries	1,830.00		
Total		4,472.00	
Total expense (excepting material and labor)			9,900.00
Net Profit			3,310.00
Percentage net profit (to gross sales, *i.e.*, 3,310 to 32,801)			10.1 per cent

As Mr. Gould suggests, the matter of "Overhead Expense" is probably often overlooked. In the above statement the term "overhead" has been purposely avoided.

The terms used in the above statement, however, will probably need no discussion, even though there may be legitimate opportunities for argument as to the placing of some of the charges shown. The main point is to get all of the charges in the statement and, if they do not come under material and labor, they should be included in one of the other forms of expense.

With the Balance Sheet worked out, in addition to the Operating Statement, the summary of the business is pretty complete, and the following may be of further interest as a typical sample.

BALANCE SHEET
June 30

Assets		Liabilities	
Cash on hand	$3,792.00	Accounts payable	$1,864.00
Accounts receivable	7,635.00	Capital stock	10,000.00
Notes receivable	82.00	Surplus	8,355.00
Inventory	6,957.00	Profit	3,310.00
Machinery and equipment	4,722.00		
Furniture and fixtures	341.00		$23,529.00
	$23,529.00		

With a similar balance sheet available for January 1, the manager has a perfectly good measure of the progress attained for the six month period and, with the operating statement, he knows exactly how the progress was made.

A good system of accounting is really not as complicated as it is often made to appear, and if more managers of the smaller industrial organizations made it their own individual business to understand and obtain the proper details, it would mean, as Mr. Gould concludes, a great benefit to business in general.

Unexpected Factors Unearthed by Cost Finding

BY J. C. P. BODE

THE innocent request for the cost of a part certainly opened our eyes to a few things recently.

In order to arrive at a price for a special part similar to a standard one, we asked for the cost of this particular standard part and were absolutely dumfounded at the figure handed us by the cost department. We calculated that the special part could be made and sold at a slight profit for very little over the cost given us of the standard one, which was supposedly made in quantities.

Investigation proved that a goodly number of the castings for the standard parts were defective in a way that would not show up until the parts were entirely or partly finished and tested. Furthermore it was found that they had been put through in lots much smaller than the demand warranted. The responsibility rested, therefore, partly with the foundry and partly with the design, as well as the general handling of the part.

As a result, a simpler design was worked out, the foundry's co-operation was enlisted, and various changes of manufacturing, as well as inspection methods, were inaugurated.

From this experience it will be seen that looking into costs occasionally does not only fix the selling price, but puts the search-light on such important factors as designing, planning, foundry work, machining, hardening, and general handling and inspection.

It certainly will pay any manager to look periodically into the cost of some of his products, with a view, not merely of establishing selling prices, but to find out whether there is anything wrong along the line.

THE · FOREMAN'S · ROUND · TABLE

Getting to the Big Boss

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

"HAD a funny case today, Al. Jim Baxter wanted to know how he could see the super. Said I hadn't given him a square deal and he wanted Williams to know about it."

"You have to admire his frankness and his nerve anyhow, Ed. But what did you tell him?"

"I told him to go see Williams if he wanted to—I wouldn't stop him."

"But how would you feel about it, Ed? Wouldn't you be a bit sore—and perhaps a bit more critical of Jim Baxter if he did?"

"Perhaps I would, Al. But how could I help it? Wouldn't you feel peeved if it had been said to you?"

"Guess I might, Ed. But Jim's case brings up a question I've thought about a lot. Just suppose you and I were the low-down type of foreman who holds grudges—or copies new ideas of the men! Of course, we're not—but just suppose we were! How would Jim or anyone else get past us to put the super wise? How would we get past the super to the G.M. if Williams wasn't the good sort of scout that he is?"

"But, Al, don't most firms tell us the G.M.'s door is always open to any man in the plant?"

"Sure they do, Ed. But if you were the kind of foreman that would make a man want to go to the big boss, you'd raise Cain with him if he went. The door might be open all right but he wouldn't dare go through it.

"If Williams was a skunk, he'd find some way of seeing that you got fired if you went to the big boss. Of course, once in a while the man down below can get things over like that, but it's seldom.

"I don't know the answer, Ed. But there ought to be some way that a workman or a foreman who feels that he isn't getting a square deal could put the case up to the big boss without prejudice to his job. Many a good man has been lost to the firm because we haven't such a plan. But I don't know the answer any more than you do."

Are Al and Ed right about the need of a way for men to get past the foremen?
Or foremen to get to the Big Boss?
Do you know of any plan that really works?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Who Should Keep Machines Oiled?

THAT is the very question I asked myself eighteen years ago when the "Super" called me and said that since I was in the third year of my apprenticeship I was to become a member of the oiler gang. A short explanation about the importance of my new job was given, and the door slammed. My two years of experience as an apprentice-oiler make me think that the views of both Ed and Al should be modified. If Bill operates his machine continuously he is the master of his machine and has to take care of it in every possible way.

The other kind of operator uses the machine for a short time only. He comes from his bench, carries his piece with him and brings his tools. He does not bother to look for oil but has his oil can filled with coolant. Even though the bearings run somewhat warm his job is finished pretty soon and the next man can do the oiling. Such machines need a man who has charge of the oiling. Let him do the oiling during the lunch hour and shift his own time for lunch, accordingly. The importance of oiling machines requires a man who is fully paid and consequently bears all the responsibilities of the work. Do not pass it on to an apprentice boy. A real apprentice will feel that he needs to be learning more than that and will dislike the monotonous work of oiling machines daily. Letting a man come in a half hour early in the morning will breed trouble because some day he will be late. If he is supposed to stay overtime a half hour, some day he will be in a hurry.

—HUGO WEISS.

Cutting Down Spoiled Work

THERE are many common causes of spoiled work. Drafting room errors and improper dimensioning are among the most important. Close co-operation on the part of the shop in promptly calling them to the attention of the engineering department will help to eliminate these.

The foreman can help reduce the amount of spoiled work caused by incorrect setting up of machines. Proper maintenance of jigs and fixtures will also help to eliminate spoiled work. Proper supervision and the picking of the right men will reduce that which is caused by the carelessness of the workman.

The inspection department can co-operate on acceptance standards by studying the functioning of the parts on assembly with the idea of recommending greater tolerances and by the analysis of rejections to determine their cause. They can also suggest easier methods of doing work and inspect by individual operations where possible. Any savings that are made through the efforts of the men should be passed on to them in the form of wages and the men should be told where the increase is coming from.

—NELSON A. BAIRD.

Personal Appearance in the Shop

I BELIEVE that Ed was wrong in putting off suggesting to the apprentice that he should keep reasonably clean. A boy acquires slovenly habits easily, and poverty is no excuse for washing greasy overalls only once a month.

When I was an apprentice at $3.00 a week—60 hours a week, too—we boys owned only one pair of overalls each, and we used to wash them at least once a week in the hot water tank in the plating room in spite of continuous bawling out from the Czar of that domain. Maybe it was only a coincidence that all of the boys from that shop graduated into executive positions.

I remember how the foreman of that same shop was accustomed to stop and give us boys a "line" of good-natured talk, incidentally getting in some remarks about quality of work, personal appearance and misuse of materials. Perhaps it was also only a coincidence that later he became the president of a big machine tool plant.

The foreman, by his personal contact, can impress the apprentice boys in casual ways on matters of personal appearance where it would sound blunt and out of place coming from the super. In theory it may not be any affair of the shop to worry about the boy's cleanliness, but in practice the visitor to the shop gets a bad impression when he sees a month's accumulation of grease and dirt on the boys. It doesn't tend to inspire general shop cleanliness, either.

—G. B. STUART.

Should Foremen Be Good Actors?

I BELIEVE that an experienced foreman should change his style of address only to a very limited degree. To the extent that we all learn from experience is about as far as he should go. Even then he should conform to the style and manner that are natural for him. This would result in a very gradual change in attitude and manner of presentation so smoothly accomplished that even those with whom he came in daily contact would not notice an abrupt chance of style.

It would be unwise to act the part of a different type of foreman in order to conform to certain "general requirements" since these are not tangible things but are

THE · NEXT · TOPIC

Shop Visiting for the Foreman

QUESTIONS

Will visits to other shops help the foreman?

Or will they amount to vacations only?

Will they make the foreman more valuable to the company?

a reflection of the management's personality. The men will be quick to recognize the acting. In a short time they will pool their ideas and conclude that he is trying to create an impression, and then the foreman is truly "lost." He will set up a reaction, lose the confidence of his men who will act back to see what they can put over on him, and arouse antagonism toward himself. Instead of working with him they'll revert to working for him—when he's watching. —FRED J. SCHIMPF.

Making Good Workmen Out of Poor Prospects

SOONER or later values are recognized, and sooner or later abilities are rewarded. The wisest thing that a manager can do is to recognize and to reward demonstrated abilities. Therefore, Al was wise in raising the pay of Schimmel. Pleasant personal appearance and disposition are valuable assets to any man, but they do not mean everything.

As a rule, every large shop has its poor workers who care about or see nothing beyond their noses. With them work is a necessary evil of life. It would be a loss to endeavor to develop them. If a man has the will to develop to something better, he will respond favorably to the test jobs which a wise foreman will assign to him. These test jobs are the means whereby the foreman can gage and grade his men for future training. It is sad to say, but it is true that a person with a poor personality is usually disliked and runs many chances of getting unfair treatment. —R. SENAY.

Cutting Down Unnecessary Repair Costs

THE careless workman who is responsible for machine breakdowns is certainly a problem. We must be sure, however, that the cause of a certain machine's breaking down is the carelessness of the workman. Having definitely fixed the responsibility, our next move is to find out if the careless act is one against which the workman has been specifically warned or whether it is one that he is not in the habit of repeating. If there are no extenuating circumstances, the sooner the man is fired the better it is for all concerned.

To prevent interruption of production when such an accident occurs, it is well to have an extra machine in reserve, or, if this is not practical, to have sufficient spare parts on hand to take care of the common breakdowns. The group bonus subject to being penalized is undoubtedly a solution of the problem so far as the management is concerned but it is doubtful if the men will take kindly to it. It cannot be denied that it penalizes the good mechanic for the faults of the management in hiring careless men. The plan, therefore, can hardly be called a good one. —GEORGE W. HARDMAN.

Personal Appearance in the Shop

A PERSON'S dress should always be in keeping with the work that he is doing. As a general rule those who are indifferent about their dress and general personal appearance are also lax in the other qualifications that go to make up a good employee. Likewise, those who lay undue stress on their dress and personal appearance usually are extremely fussy on some few points and negligent of other important ones. However, there are exceptions. Sometimes the individual careless of his dress has a strong personality which offsets his carelessness about his clothes.

In such cases as the latter the boss would usually and wisely hesitate to advise a change in the manner of dress. The few cases who do not fall into the classes mentioned above should be carefully studied and if it is found that they feel they have a good reason for appearing in what seems to be unsuitable dress they should be shown the advantages to be had from an improvement in that direction. There is a great responsibility resting on every one from the management all the way down to see that the organization is orderly and neat in its housekeeping.

—JOHN MARK MAY.

Cutting Down Unnecessary Repair Costs

A FOREMAN'S opinion of any slip of memory or carelessness on the part of a man operating a machine which leads to putting that machine out of action is not likely to be very judicial or biased in favor of the culprit, but so long as machines are operated by human beings it is as well for any foreman or superintendent to recognize that a certain number of these accidents are bound to occur.

It is also true that the stronger incentive a man has to keep his mind on the job at all times, the less likely are accidents to happen. As most men work machines for what they get in the pay envelope at the end of the week, a bonus penalty should certainly help considerably to keep down damage to machines through carelessness.

The weak points about the scheme as described by Al, appear to be, firstly, that one accident on an expensive or complicated machine penalizes the men in the department possibly more than a dozen similar ones on a machine of simpler type; secondly, the careless man gets the same bonus as the careful man.

Although repair costs must necessarily come out of the whole bonus, it appears that a much fairer way of dividing the balance at the end of a period would be in proportion to the number of accidents per man. In the same way that firms now post production records, it might be a good plan to post accident records.

—S. DARK.

Keeping Men Interested in the Job

INTEREST is a very elusive factor and needs a constant stimulant to be active. One safe method to use is to limit the time spent on a certain type of job. This will prevent the workman from sinking into a rut where interest is usually very low. Interest cannot be maintained unless several contributing conditions are kept up. One of the most important of these is wages. Good wages constitute the salt of the pudding and must be present if interest is to be maintained.

In my judgment, Al will find that the interest he expects from the men will not reach the level for which he hopes. On the other hand, Ed is too severe in his judgment on this subject. Interest is seldom really dead but if it is poorly fed it will be rather weak. A shop using bulletin boards designed to act as an interest-building medium has never come to my attention, but

I feel that it would be rather difficult for the average workman to take a lesson in improved quality, for example, from a picture and to intelligently apply it to his particular job. Bulletins of this kind will gratify natural curiosity but something more substantial is required for sustained interest in getting out the maximum amount of good work.

—LAWRENCE F. SWENSON, *Standards Engineer.*

Who Should Keep Machines Oiled?

WHEN one man is made responsible for the oiling it is much more likely that the machines will be oiled regularly than when the oiling is left to the individual operating the machine.

If Al is going to use an apprentice boy for the job instead of a regular man, he should give each of the boys a turn at it, say for six months each. In this way all the boys will have an equal chance to learn the different machines and at the same time the proper care of the machines.

Al's idea of paying the boy a bonus for every week that there isn't a breakdown due to bearing trouble, will do away with any tendency on the part of some boys to neglect their jobs. —THOMAS M. GARRY, *Foreman.*

Should Foremen Be Good Actors?

IT IS my impression that a foreman should cultivate an authoritative demeanor but not necessarily a commanding one. Acting is generally coarse and soon becomes tiring to men. The person of neglected education is prone to appreciate the foreman who speaks correctly. Too much luster or polish, however, has a somewhat repulsive air among men.

The sort of talk that is generally delivered by the "hat-over-one-ear" foreman is usually abominable and places the foreman right where he should be—below the standard desired by his superiors and required by the men. Good language will make for good appearance. The manner of addressing a group of men can be changed somewhat from the style used when speaking to an individual. The style used when speaking to a group of men approaches that used on a platform.

The foreman who tries to substitute an outright change for his general manner is quite likely to draw that old familiar expression, "Hire a hall." Therefore, a good plain sincere manner backed up by common sense is the best policy.

—STORRS T. RICHMOND, *Master Mechanic.*

Who Should Keep Machines Oiled?

MOST machinists, not on production work, can be relied upon to see that their machines are properly lubricated. With the pieceworker the situation is quite different, for his efforts are concentrated on production. The service which an oiler is able to perform for the former may be limited to an inspection of the oiling system in general to see that no pipes or oil grooves are clogged, that no caps or cups are missing, that the gears are properly packed in grease and that the bearings as a whole are in good shape.

The production worker, on the other hand, should be expected to keep only the visible oil cups filled and properly dropping. The oiler must take care of all the rest. He should oil all hidden bearings and examine them frequently to keep the driving mechanism in good order and to warn the operator of any bad practices which may be slowly impairing the operation of the machine. Where there are many machines in the department which are only in periodic operation, a good oiler is indispensable. —A. M. MORRIS.

Getting Men to Observe Safety Rules

PLACING the responsibility for an injured man is rather a tough proposition. In very few instances can anybody be blamed other than the man himself. The safety department has posted signs in conspicuous places with several "do's and don'ts" and the foreman has cautioned the men also, but, somehow, accidents happen.

The foremen should see that all safety rules are obeyed and when an instance occurs of a man ignoring the rules, he should be reported to the foreman for a disposition of his case. It might be that a rebuke would suffice, yet dismissal may be necessary for a serious infraction of the rules.

The prevention of accidents around grinding wheels can be handled in several ways, the most important of which is to require the use of goggles. A vacuum or exhaust system to collect the dust is a big help but it should not replace the goggles. Several companies periodically offer a prize to the department with the least accidents. This has shown a marked decrease in accidents for a time but after a while the curve will rise.

—B. C. THOMAS.

More About Discipline in the Shop

I BELIEVE temporary demotion to an unskilled job as a punishment is more likely to kill than cure. To my mind it conjures up the picture of the "bad boy" in school who was made to stand in the corner. This always gave the "bad boy" a sort of cheap publicity, and was a confession of weakness on the part of the teacher in that she thus indirectly but openly admitted her inability to handle him. If he was bad enough to warrant this punishment, why, I believe he was bad enough to be suspended from the school or otherwise severely punished. So it is with the workman; if all other "reasoning" methods fail and he is finally regarded as a candidate for demotion, why he ought to be just plain "fired." For if you can't appeal to his better nature to get results, I can't see how you can reach him by any such weak-kneed tactics.

I don't see how it can be done without making inroads on the company payroll, for otherwise the man will probably "quit" on you. While this may be one way of solving the individual problem, it certainly does not strengthen the management's position with the other men.

If you have to make inroads on the company's payroll, the treatment is certainly not worth the cost. The chances of success I regard as very small, as you are really not appealing to a man's highest senses, but to a child's fear of ridicule. —M. A. MILLS.

Ideas from Practical Men

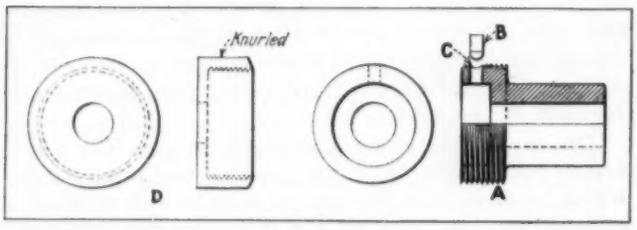
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Holder for Button Dies

BY H. C. LINCOLN

The illustration shows a button-die holder that can be used in either automatic or hand screw-machines.

The die is inserted in the holder *A* and the pin *B* is dropped in the hole at *C*. The inner end of the pin fits



Button-die holder for the screw machine

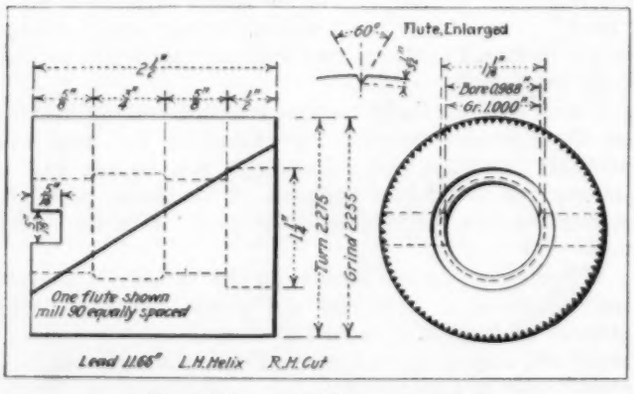
in a dimple in the edge of the die. The pin should be of a length that will allow its outer end to just come flush with the root of the thread on the holder.

With the die in place, the cap *D* is screwed on the holder. In this device there are no screws to come loose.

Finishing Tool for Follower Cams

BY P. CLICKNER

Where follower cams are employed to impart motion in high-speed automatic machinery, it is essential that the working surfaces be exceptionally smooth. If this is not accomplished, the entire mechanism will fail to function properly, and the lives of the cams will be greatly reduced. Where mass production is required it is also important that the width of the grooves be held to close limits to assure interchangeability, so important in regards to assembly and service.



Knurl for finishing cam races

The "knurling" tool shown in this article has proved to be a splendid performer in finish-milling cams of the type referred to, in the plant where I am employed. The cams are of cast iron having small vanadium content, and are a vital part in the fabrication of our product. The operation is actually a combination of cutting and burnishing, resulting in a glass-like surface that is true to contour and width. The knurl is bored, counterbored, and keywayed to fit standard shell-mill arbors, and is very economically produced. Since the most important factor is resistance to abrasion, extreme hardness is desired, and a good grade of carbon steel properly heat-treated to show about 95 scleroscope proves satisfactory.

The cams are first rough milled with special roughing mills of the inserted-blade type, which permits maintaining a standard diameter by packing and regrinding the blades. This feature assures standard results in the finishing operation since the amount of stock removed (0.006 in.—0.003 in. on each side) is always constant.

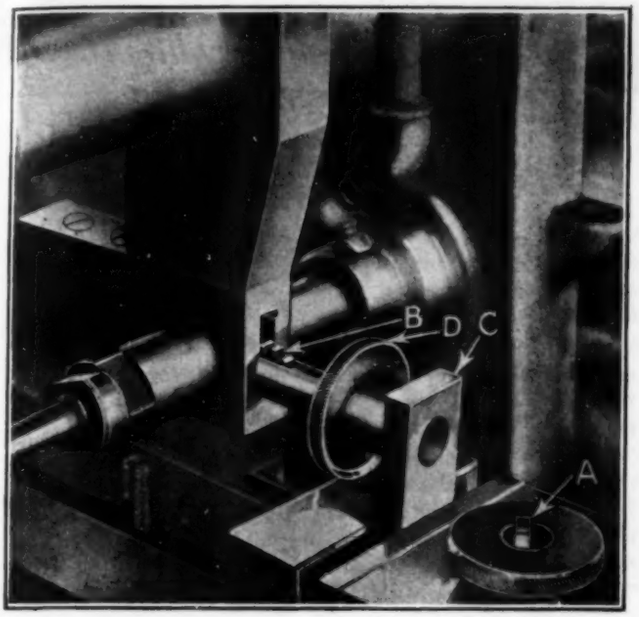
The knurl operates in a flood of oil at 72 r.p.m., and the feed is approximately 0.018 in. per revolution.

The illustration shows one of several sizes of these tools used at our plant, and, needless to say, the dimensions are given only to furnish an idea of the proper proportions and must, of course, be altered to suit individual requirements. The number of flutes for varying diameters should be suitable to retain the $\frac{1}{32}$-in. depth of cut and approximately 0.040-in. width of land.

Milling a Keyway in a Collar

BY E. V. ALLEN

In a collar used on one of our special machines there is a keyway cut in the form of a quarter circle, or 90 deg. segment, as shown at *A*. The work is done in a plain milling machine, using the fixture illustrated. The main body of the fixture is clamped to the overarm and the machine arbor is run through a small gear meshing with the cutter *B*. The bar carrying the cutter is made long enough to enter the guide, or steadyrest, *C*, during the cutting process. The steadyrest is merely a piece of bar steel with a hole in it, and is held in the regular machine vise. It serves not only as guide and steadyrest, but also as a means of feeding the work to the cutter. When putting a collar on to the cutter bar, the table of the machine is run back far enough for the guide to clear the bar and to allow a collar to be slipped into place as shown at *D*. The table is then run forward and the work is fed to the cutter as far as



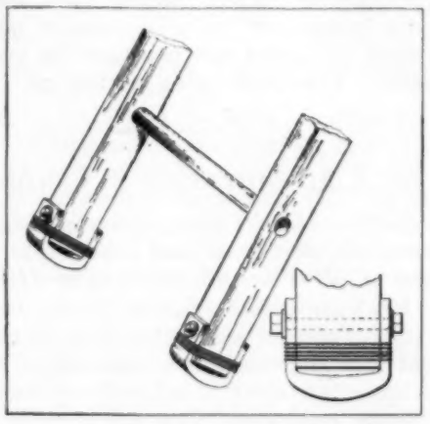
Milling fixture for internal keyseats

it will go, which gives the desired shape and depth to the cut. No holding clamp is needed for the collar during the cutting, since the collar fits the cutter bar closely and the cutter teeth cut downward, pressing the collar against both the bar and the guide as it is pushed forward. Soap water is used as a coolant.

Safety Devices for Ladders

BY H. L. WHEELER

Many accidents are caused by the careless use of ladders. The most frequent and serious ones result from ladders slipping and throwing the workmen to the ground. Especially in shops and warehouses are precautions necessary against the possibility of a slipping ladder. There are, of course, many different schemes in use, and several good commercial devices are available. Yet one of the cheapest and best methods I have seen is the use of a piece of old tire casing secured to the ladder feet as illustrated. Two narrow sections are cut out of the casing. A clearance hole for a ¼-in. bolt is drilled through each foot. A bolt with a washer on each side is then used to hold the rubber pad in place, after it has been drawn up tight over the ends. Near the bottom, these pads can be bound with several turns of iron wire to hold them firmly in place. Surely this method is not much trouble or expense to prevent injury to a workman.



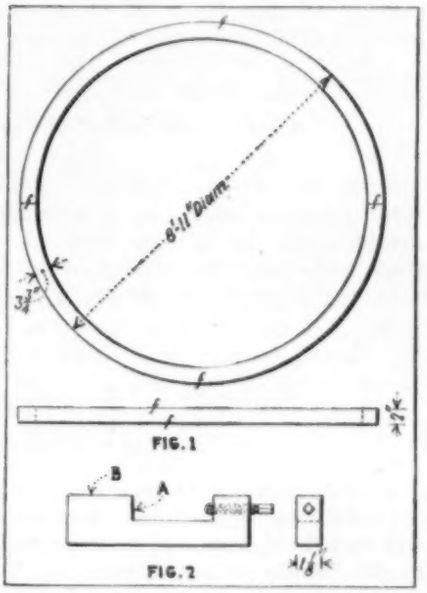
Device to prevent ladder from slipping

Machining Large Steel Rings

BY H. K. GRIGGS

We had several forged steel rings, as shown in Fig. 1, to be faced and turned on the outside. Since the rings were in two parts, they could not be held in the chuck jaws with which our boring mill was equipped.

Using a cutting torch, I cut eight clamps out of a bar of 3½x1¼-in. steel. One of the clamps is shown in Fig. 2. The face *A* was machined so as to insure a truer clamping surface. A hole was drilled and tapped for a ⅝-in. setscrew, as shown. The lower part of each clamp was reduced to 1¼ in. in width so as to enter one of the slots in the machine table. The clamps were put on the rings and then dropped into the slots, where they could float while the rings were being set true. After the rings were set, the clamps were held down by U-straps on their inner ends at *B*. The rings were then faced without difficulty.



Figs. 1 and 2—The ring and one of the clamps

For turning the outside, the rings were stacked two-high on the table and clamped on one of the faced surfaces. We have used similar clamps for holding rings as light as ⅛x2 in. in section, and have machined them without appreciable spring.

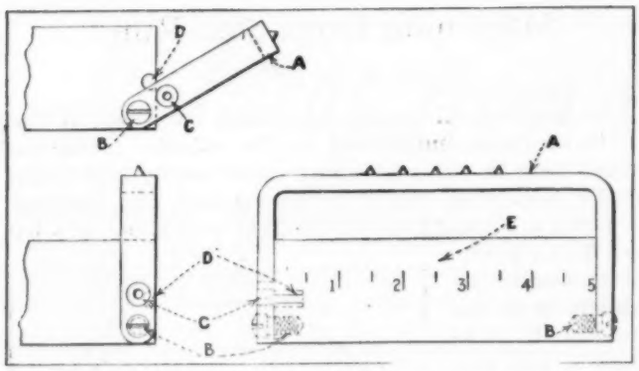
Attachment for Cutting-Off Raw-Hide Pins

BY BERNARD R. SCHNEIDER

Some time ago I made some changes in a Clipper belt lacing machine, whereby the raw-hide pins for connecting the belt ends could be cut off. Thinking that the scheme might be of use to others I am passing it along.

On the machine as built, the swinging belt-support *A* is pivoted on the studs *B*. At one side of the support, I drilled and reamed a hole close to one of the pivots, and inserted the hardened bushing *C* having a hole of a size to allow the raw-hide pins to slide through easily. The inner end of the bushing is flush with the inside of the

In the base of the machine, at the same distance from the pivot as the hole for the bushing, I drilled and reamed a hole so that it broke through slightly at one edge. In this hole I inserted the hardened plug *D*, the outer end of which just cleared the inner end of the bushing as the support was swung upward. The base was then graduated as shown, as a guide for cutting the pins to the length wanted.



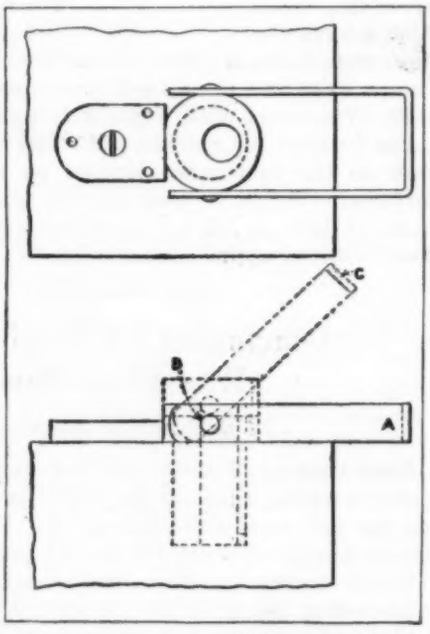
Changes made in belt lacing machine

Since the adjacent edges of the bushing and plug form shearing edges, it is necessary only to put a raw-hide pin through the bushing to the proper distance and swing the support upward. This action results in cutting off the pin neatly and quickly.

A Sheet-Steel Bushing Lifter

BY ARTHUR KENDALL

In some work it is necessary that the drill jigs be fitted with one or more bushings having eccentric holes, and that these bushings must be removed and replaced by others for different parts of the operation. As a rule, eccentric bushings are located by a pad on the jig engaging a flat on the bushing head. This arrangement presents one difficulty to the operator — that of removing the bushings. If a bushing can be twisted out there is generally no trouble in removing it, but lifting it up so that the head will clear the pad is another matter. As an experiment we fitted two of our bushings, located by pads, with lifters as shown in the illustration. The lifter *A* is a piece of sheet steel bent into a U-shape and attached to the bushing head by rivets, as at *B*. The short end of the lifter acts as a cam, so that when the opposite end is raised to the position *C*, the bushing will be lifted and the head will clear the pad. With the bushing so raised, the lifter can be used as a lever to twist it out of the jig. The distance between the rivets and the short end of the lifter must, of course, be greater than the thickness of the pad.



Simple lever for lifting bushings

Practical Shop Problems

Questions of a Practical Nature will be answered in this column

Choosing a Bearing Metal

Q. What is the comparative longevity of bronze bearings and bearings of die cast metal? Are you in a position to advise us what die-cast metal formula would be best as regards longevity?

A. It is impossible to recommend anything definite in regard to a bearing metal without full information as to the size, shape, speed, and bearing pressure of the bearing.

Outside of the field of plain cast-iron and steel bearings there are four groups of the softer metal bearings in which an infinite number of combinations can be made. The lead-base bearing metals are the softest, and are used where bearing pressures are not high. These alloys usually contain from 60 to 85 per cent of lead, from 10 to 35 per cent of antimony, and up to 5 per cent of copper. The tin-base bearing metals are somewhat harder, and are used where the bearing pressures are higher. They contain from 45 to 85 per cent of tin, from 4 to 25 per cent of antimony, and up to 8 per cent of copper. They may also contain lead. The bearing bronzes are hard metals rich in copper and with widely varying percentages of tin and zinc. They also often contain other metals. The die casting alloys contain chiefly zinc, aluminum, tin, and copper. The variety of combinations of these alloys is unlimited. Almost any book on the non-ferrous metals will give you details and analyses of the principle bearing metals.

Each of these bearing metals is best adapted within a definite range of bearing pressures, and usually within certain speed ranges, but other important factors also enter into the selection of a bearing metal. For example, a small plain bearing that is in effect nothing more than a simple bushing might best be made up in quantities in a screw machine from bronze or brass bar stock because of the cheapness of manufacture, even though the speed and pressures do not require a hard metal. Appearance also is often an important factor.

Carbonization in Compressors

Q. We have had some difficulty with carbon deposits in our air compressor, and believe it is due to the wrong kind of oil. What oil should be used?

A. Your trouble may be from an excess of oil as well as from oil with a low flash point. It is possible that the compressor is overloaded, or the water supply to the intercoolers is not sufficient, and excessive heat is being generated. This might cause the attendant to put in an oversupply of oil.

We are inclined to believe, therefore, that the trouble is serious enough to warrant a thorough investigation. Clean the cylinders, valves, and piping, using a soft soap solution if necessary. Be sure that you have enough compressor capacity so that the system is not running at continuous peak load. See that the oil feed to the cylinders is slow and uniform. Use a good grade of motor oil.

Magnesium and Its Alloys

Although magnesium was first obtained in 1808, it was only recently that its commercial value for the production of light alloys was recognized. New methods of reducing it from its ores have made possible the production of large quantities of the pure metal at low prices, and it is now being used in automotive production and in places where extreme lightness of parts is required.

Magnesium is the lightest of all known metals. It is only 65 per cent of the weight of aluminum, and only 22 per cent of the weight of steel. Magnesium, when pure, is a lustrous silvery-white metal. Its melting point is 1,204 deg. F., which is only 16 deg. below that of aluminum. But when heated in the air to a point slightly above the melting point, magnesium burns with a brilliant white light. The tensile strength of cast magnesium is as low as 13,000 lb. per sq.in., and of extruded magnesium 28,000 lb. per sq.in. Due to its great affinity for oxygen magnesium is employed as a deoxidizer in melting copper, brass, and nickel. It is also used extensively in fireworks, and for flashlights.

Magnesium is not used commercially in the making of parts except in alloys. The usual alloying metal is aluminum, and the proportions generally vary from 88 to 96 per cent of magnesium and from 4 to 12 per cent of aluminum. Another class of aluminum alloys contains magnesium in only small quantities. Magnesium-aluminum alloys are considerably stronger and tougher than magnesium alone.

Heat Treating

Sand castings of magnesium alloy containing 88 per cent of magnesium and 12 per cent of aluminum have a tensile strength of only 19,000 lb. per sq.in., but when heat treated show strengths up to 31,000 lb. per sq.in. This alloy, when extruded, has a tensile strength of 45,000 lb. per sq.in., and in rolled sheets as high as 53,000 lb. per sq.in. Increasing the proportion of magnesium and lowering that of aluminum decreases proportionally the tensile strength of the alloy. A magnesium-aluminum alloy with 96 per cent of magnesium, when cast and heat treated, has a tensile strength of only 25,000 lb. per sq.in.

In heat treating magnesium alloy castings it is only necessary to hold them at a temperature of about 800 deg. F. for a short period of time. If the piece is cooled rapidly after treating, a hardening effect takes place.

Magnesium alloys cannot be bent cold easily, but rolled sheet should bend without cracking around a radius 3 times the thickness of the sheet. Spinning and drawing of magnesium alloys are impractical due to the rapid hardening of the metal under cold work. But hot pressing of the alloys can be done at temperatures from 650 to 850 deg. F. At these temperatures the metal, when compressed into a confined die, will flow into very thin sections and reproduce fine details. Riveting, or upsetting work of any kind, must also be done hot, and with hot tools.

Machining the Alloys

Magnesium alloys are machined easily. The metal does not tear, and chips do not cling to the tools. A higher speed may be used than is employed for brass. Carbon steel tools are used as for brass, and there is no advantage in using high-speed steel tools. Cutting lubricants are not ordinarily used.

Cutters for milling magnesium alloys should have coarse teeth, and for cutters 3 in. or larger in diameter a clearance angle of 4 deg. is used. For smaller cutters an angle of 6 deg. is employed. Spiral fluted cutters with 15-deg. spiral are recommended. Smooth cutting edges on all tools, as for brass, are necessary. The fine cutting edge is obtained with an oil stone. Reaming should also be done with spiral fluted reamers. Carbon steel drills are used on these alloys, and may be run at 150 ft. per minute.

For the average turning of magnesium alloys a round nose tool will give good results. It should have a side slope of from 12 to 15 deg., and a clearance of about 12 deg. Cutting speeds up to 200 ft. per min. can be used for general work. Cuts as deep as $\frac{3}{4}$ in. can be made with a $\frac{1}{16}$ in. feed, but for finishing work fine feeds are recommended.

The fine chips from magnesium alloys will ignite and burn easily, and thus constitute a fire hazard in the shop, but the metal in bulk forms is safe to use without fear of ignition under ordinary circumstances. Magnesium-aluminum alloys are attacked by acids and salt solutions, and also oxidize easily in the air. Parts made of these alloys should therefore be protected by a coat of paint, varnish, or lacquer.

Parts made of magnesium alloys can be brought to a high state of polish by ordinary polishing methods. Sand blasting is also used effectively in cleaning and polishing the parts. In plating magnesium, however, acid solutions must be avoided due to their corrosive action on the metal. For copper plating a cyanide solution is used. Parts to be nickel plated should first be given a coating of copper.

Magnesium alloys have their greatest use where lightness is of first importance. They are being employed for the pistons of automobile engines, and in airplane work for such parts as crank cases, oil pans, gasoline tanks, and small parts.

For the information given we are largely indebted to the American Magnesium Corporation

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Technical Abstracts

Diesel vs. Steam Engines for Ships

The proponents of the Diesel engine for marine work talk about the low oil consumption compared with the relatively high consumption of steam plants. But fuel costs represent a difference of more than 45 per cent in favor of the boiler fuel. Bunker oil today costs $1.65 per barrel as compared with $2.40 per barrel for Diesel oil.

There are also very great differences in both cost and weight of the machinery. Moreover, speed control and flexibility, which are emphasized as features of the Diesel-electric drive, are equally applicable to all types of electric drive, and are not peculiar to the Diesel.

The weight of a Diesel installation will be greater than a steam plant, and in cargo boats this is important as it enables the vessel with a steam plant to carry more cargo. On one cargo boat the increased cost of Diesel machinery over a steam plant was 35 per cent. Taking into account all of the advantages of the Diesel machinery, the best possible return would be an operating saving of 6 per cent, but the extra charge of 15 per cent to cover interest and depreciation on the investment would result in a net loss of 9 per cent. The Diesel engine has its advantages, but it hardly seems reasonable to shroud it with wonderful achievements without getting down to the basic problems that we must consider. —J. H. King, in *The Marine Journal*, Dec. 11, 1926.

Variable Power Transmission

There has now been solved an outstanding problem in the mechanical transmission of power that is, a positive-drive infinitely-variable gear. With this gear it is claimed that it is possible to alter within the range of the gear the speed ratio to an infinite degree between a driven and a driving shaft by the operation of a single lever. This feature makes the gear of great value for alternating current motor drives.

The essential principle of the gear consists in the use of a driving chain of special construction running between two split pulleys of the opposed conical disk type sloping down on the inner faces at an angle of 30 deg. to the shaft. These sloping faces contain alternate ribs and grooves radiating to the center. These ribs are staggered so that a rib is always opposed to a groove. The chain is engaged at the edges by these ribs, which act as teeth so that the drive is positive.

In order to alter the speed of the driven shaft it is only necessary to slide the halves of the split pulley along a slight amount by means of the lever. When the halves are brought together the chain rises in the grooves, giving the effect of a driver of a larger diameter. The test of a 5-hp. unit showed positive speed changes from 300 to 1,800 r.p.m., and transmission efficiencies from 87 to 95 per cent.—*The Electrician* (London), Dec. 10, 1926.

Dual Ball Bearings

An unusual ball bearing is being made by the Auto Machinery Co. Ltd., Coventry, Eng. It consists of two rows of balls, on different diameters, the larger balls being at a larger radius. The two rows are staggered so that the balls overlap to some extent, although the paths are well separated. The design is said to have increased load-carrying capacity and to give an appreciable resistance to end thrust. The finished bearing is interchangeable with existing standard sizes of single bearings.—*American Machinist* (European Edition), Dec. 18, 1926.

Radial Air Motors

The Cardiff Engineering Exhibitions held recently contained an interesting development in air motors for winches and similar work. One exhibited by Broom & Wade containing six radial cylinders, in two sets of three, had a number of interesting features.

The cylinders are in the ends of a three-lobed revolving member. They carry trunk pistons with large rollers that contact with a stationary cam of oval shape, which permits the rollers to revolve the whole cylinder unit. The air is admitted and exhausted at the center by means of a simple and ingenious valve. The valve is stationary except when it is desired to reverse the direction of rotation. A valve of conical shape is used and is held to its seat by the exhaust pressure on the larger area of the base. Should it seize, a slight turn closes the air admission holes and the compression of a piston on its return stroke frees it automatically. The general appearance is such that it might be easily mistaken for an electric driven winch.—*Engineering*, Dec. 3, 1926.

The Conditions of Industrial Production in the United States

In a speech on this subject, M. Detoeuf, director-general of the French Thompson-Houston Co., returned from the United States, said that America is a huge country, where everything is done easily because of its vastness, rich in raw materials and in gold, but her greatness is not in these conditions; her riches are not only her wealth and her raw materials; her greatness is in her men and her methods. The material aspect is small beside the moral aspect.

The minimum salary in the United States is about five times the minimum salary in France. In America half the workers have their own radios, their telephones, their automobiles, they will soon have their own refrigerating machines. When one considers the fright which seizes our souls at the menace of raising the salary level, one cannot banish the thought that to double our salaries in gold would constitute a catstrophe. But America is not existing in the state of a catastrophe.

It is the power to purchase which makes prosperity. The native economy of the Frenchman is perhaps an obstacle to the extension of our markets. Another factor is standardization. It is perhaps our individualism which gives us most to fear in the battle for our financial relief. The Frenchmen have a horror of being clothed alike, of buildings constructed alike, and of electric motors that all look alike. Our individualism prevents us from paying more to our workers. Our aim ought to be not to manufacture five times as many different kinds of products as we do, but to manufacture five times the amount of the same product that we do.

The American industrial organization is efficient though complex. No prospective business comes to one's attention without it being run to the bottom. No one can complain of slowness. Plenty of time is devoted to the customer's business. That requires a large personnel. Then again the aim is always toward progress. There is no waiting until progress is forced on them.

M. Detoeuf has urged less individualism, a voluntary acceptance of standardization and normalization, greater solidarity, a feeling less constrained by personal interest, less irrational tradition, more faith in the future and efforts to develop its possibilities.—*Le Genie Civil*, Dec. 11, 1926.

Gas Warfare and Industrial Preparedness

In chemical warfare it would appear unlikely that substances of much greater military value than those we know today will be discovered. Like all weapons, gas has its limitations. Immense quantities are needed in order to produce the desired effect over an area of a square mile. To produce the required concentration over a city like Paris it would be necessary to employ 1,000 airplanes to carry phosgene, each of which would have to make two trips.

With mustard gas it is necessary to have 25 tons to contaminate a square mile. Mustard gas remains on the ground for long periods, and its invidious nature made it responsible for most of the gas casualties during the war. The properties of mustard gas, however, make it unsuitable for use except as a defensive weapon.

However, chemical warfare presented a serious problem which demanded ef-

fective measures of defense. A nation's fighting strength is now largely dependent upon its industrial strength, and it might be necessary even to maintain plants in excess of present requirements. The modern industrial trust offers the advantages of the pooling of resources, while it demands international agreements with regard to markets for raw materials, thus eliminating one of the most likely causes of wars.—Brig. G. H. Hartley, in *Chemistry and Industry*, London, Dec. 3, 1926.

What Interconnection Means to the South

While legislators in Washington are arguing the merits of government versus private operation of the Muscle Shoals power plant, physical interconnection of transmission lines in the Southeast is progressing rapidly. For the six states of North and South Carolina, Georgia, Alabama, Tennessee and Kentucky the kilowatt hour output of central stations has increased from three to five billion in five years. The development of industries and the wider use of electric power is the cause. The value of all the manufactured products of the South in 1923 was double the value of the agricultural products. If Muscle Shoals is turned over to private power interests the principal obstacle to a complete development of power interconnection in the Southeast will be removed and Southern industries will grow accordingly. — W. Bathon in *Electrical World*, Dec. 25.

Welding Structural Steel

While there is every indication of the growing use of welding in structural shapes, both for buildings and as machine bases, there are several points to be considered if the greatest success is to be assured. There is no question as to the possibility of welding the steel members of a building instead of riveting. But safety requires attention.

Careful tests of welding in fairly large quantities, indicate that 85 per cent of the tonnage of cast iron formerly used for column bases and similar parts can be made of structural steel with a saving of approximately 50 per cent. Welding operations, involving the use of about 15,000 tons of steel also indicate that many machine bases can be built up of structural shapes rather than of iron castings.

Joints must be designed for welding, taking into consideration the metallurgical limitations of welding. Adaptation of riveted designs are not satisfactory from the cost standpoint. No weld failures have been noted in any of the experiments. The average cost of welded joints was under $20 per ton and 20 per cent of material was saved. High grade welders must be used and careful supervision exercised. —Robert E. Kinkead, in *Engineering News-Record*, Dec. 23, 1926.

Engineering Employment

Among the outstanding handicaps in employment negotiations is the failure on the part of the employer to state his full requirements. An employer should state what he wants done, the facilities with which he has to do it. The result will be that the engineers can then state their qualifications in such a way as to permit the employer to see if they can accomplish the result.

There is also a class of employers who state their requirements in a way that will underestimate the responsibility. This is done with the hope of cutting the compensation for the services. These employers have to learn from sad experience that they get what they are paying for and no more.

Employers are coming to a keener appreciation of engineering services. Where the engineer is willing to work for a lower compensation than his fellow engineers there is something wrong. Organizations, through a heavy cost in errors and in turnover, have come to a better realization of the value of employing competent engineers and paying them reasonable salaries.

The responsibilities in the engineering profession are of such a nature as to require proven ability. But with an enginering education a man has a foundation which should be worth a living wage and the opportunity further to demonstrate his ability. Where the employer has no room in his organization for the advancement of the engineer, it will be of mutual advantage if he is released. The employer who induces an engineer of this nature to stay, lessens the output of his entire organization by the widespread dissatisfaction which is sure to come.

Conditions in the past have been the means of driving many qualified engineers out of the profession into other fields. Repeatedly the engineer has proven that he does not entertain any thoughts toward union movements. But the employer who will pay engineers reasonable salaries and offer advancement is the one who will get the qualified men.—R. H. Lisboa, in *Professional Engineer*, November, 1926.

Excessive Noise Eliminated by Rebuilding Trucks

By remodeling and rebuilding some Brill 27-G trucks, the Grand Rapids Ry., Grand Rapids, Mich., has decreased troubles in service and eliminated excessive noise. In rejuvenating the trucks, they are entirely dismantled, after which the side frames are carried to the welding department where all worn or cupped portions are filled in and ground off. Considerable trouble has been experienced with frames breaking through the pedestal guides at the outside end. The driving motors are outside hung and their weight on the extreme end of the truck-end frame undoubtedly contributed to this breakage. To strengthen the side frames at the outside pedestal jaws, a piece of 1½-in. square bar steel is welded to the frame to form a diagonal brace. This brace, extended along the top of the truck pedestal and then diagonally to the outside edge of the side frame, is fastened securely by welding. Its installation has eliminated breakage at this point.

At the same time the other remodeling is handled, a new type journal box is installed. With the old type box, a 2¾-in. length journal brass was used. The new journal box permits the use of a journal brass 7½ in. long. With the old type of brass, wear was excessive at the end next to the check plate, resulting in a tilting up of the end. With the new brasses, a full length bearing is attained so that there is much less wear, and the results obtained indicate an average of 2½ times as much service from the new bearing as from the old. Strengthening of pedestal jaws has eliminated breakage, new journal boxes and brasses have stopped hot bearings, and the fiber insulation has reduced noise. — *Electric Railway Journal*, Dec. 18, 1926.

Ventilation

Within the last few years building ventilation has been put on a qualitative basis. Originally temperature and air change were the only factors considered. Then moisture content was recognized as a modifying factor and, more recently, the rate of air movement. Good ventilation also implies cleanliness and absence of odors.

For people normally clothed, and slightly active, in still air, the most favorable temperature conditions are 68 deg. F. on the dry-bulb thermometer and 58 deg. F. on the wet-bulb. This corresponds to a relative humidity of 55 per cent. As air movement increases a higher temperature is desirable. With a given wet-bulb temperature of 58 deg. the dry-bulb temperature should be 1 deg. higher for each 50 ft. per min. increment in air velocity. Thus, if the air velocity is 100 ft. per min. the dry-bulb temperature should be 70 deg. F. Experience with desk fans in summer and with special fans near furnaces and in deep mines bears out the reasonableness of the theory.

Overheating is one of the most serious defects of heating and ventilating installations. With the usual per cent of humidity a dry-bulb temperature of 75 deg. F. may lower individual efficiency 15 per cent. This loss must be added to the loss from burning too much coal.—W. A. Rowe, in *The Management Review*, Jan., 1927.

Foremanship Training

At the present time it is being recognized to an increasing degree that the foreman is an indispensable factor in any industrial organization. Human nature and human motives have not changed and are not likely to change very much, in spite of the fact that science and invention have changed working conditions.

Regardless of the degree to which an industry is mechanized, men are still necessary, and industrial executives are, to an increasing degree, recognizing that no scientific or pseudo-scientific plan of personnel management can wholly displace the foreman.

The improvement of foremanship is therefore, one of the problems in which there is a nation-wide interest at this time, and the question as to what can be done to help the foreman in industry is of major importance.—Frank Cashman, in *Abrasive Industry*, January, 1927.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

Education and Research

MUCH, if not all, of our present prosperity depends upon our educational system, our methods of disseminating information. Civilizations have arisen and vanished in the past but never before has there been one founded on the mass of knowledge and available experience that supports our own.

Our methods of recording and imparting information being what they are we must next turn our attention to finding some means of adding to the store of knowledge. It is ready at hand but very few of us have recognized it to the extent of giving it the generous financial support it deserves. The means is basic research in pure science and the return it will make to those who invest in it is sure to be great and may be tremendous.

We have not got as far as we can get with our present store of knowledge but our future progress will be seriously, perhaps fatally, limited unless we extend it through research.

Eliminating Sources of Production Profits

SPECIAL machines, or special equipment on standard machines, are very frequently the geese that lay the golden eggs of production profits. But unless the makers of these machines or attachments can receive enough nourishment, in the way of prices high enough to pay for designing and building them, the profit producing geese may become as scarce as the dodo.

Users of such machines, whose product runs into tens of thousands, fail to appreciate the necessity of charging the cost of engineering and development to a small number of machines. And, not appreciating this factor in costs, they object to paying adequate prices for machines that frequently save almost unbelievable sums in direct labor.

A recent visit to a concern that has won an enviable reputation as a builder of special labor saving machinery revealed the fact that this part of its line had been abandoned because the returns were not sufficient to pay for the engineering work, and the grief that all too frequently attends work of this kind.

Others will, of course, continue to build special machinery in the constant hope that the "next" order will pay a good profit. But those who now judge the value of special labor saving machines from a pound basis should think carefully as to the possibility of killing the goose that lays the golden eggs for them.

In Emergency

THESE piping times of peace have lulled more than a few of us into forgetfulness of the harsh lessons learned in 1917 and 1918. It is well, therefore, that we be reminded occasionally that even a peaceful nation with no aggressive ambitions must be prepared to defend itself when an emergency arises.

Thus the preliminary report of the committee on industrial preparedness of the National Association of Manufacturers is a jolt to our complacent indifference. The report tells us once more that "all the knowledge needed to organize and employ an expanded army is automatically maintained by the peace-time activities of the country with the all-important exceptions that knowledge of the use of arms and knowledge of the manufacture of arms must be stimulated in times of peace in order to be available adequately and promptly in event of emergency."

When we realize that only 24 regular army officers have been assigned to the task of educating industry in the manufacture of arms we must recognize the fact that industry must meet them more than halfway if any kind of results at all are to be expected. If you want to cooperate and don't know quite how to start write to the Assistant Secretary of War, Hanford MacNider. He heads up the whole industrial mobilization plan.

Where Small Savings Count

QUANTITY production demands the utmost care in design. A few ounces more metal than necessary become tons on a large production schedule.

To increase the safety of the user the new Ford cars have somewhat larger brakes and drums than formerly. And this small increase has required 13,000 tons more cast iron and 10,000 tons more steel than before.

In how many cases can this change be reversed by reducing the weight of a part that is unnecessarily heavy? A similar reduction in weight would have saved 23,000 tons of material instead of increasing it.

If, instead of determining many dimensions arbitrarily, they could be calculated by competent engineers, much of our present waste in materials could be eliminated. A good engineer could frequently save his salary by eliminating the waste due to material alone.

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Bethel-Player No. 1-H Semi-Automatic Hole-Lapping Machine

The Bethel-Player Co., Westboro, Mass., has added to its line of lapping machines the semi-automatic machine here shown, to lap ground holes in hardened ring-gages, tappet-rolls, valve-guides, bushings and similar parts. The cycle movement of the machine is continuous and, except for unloading and reloading the work, automatic.

Holders for the work are necessarily designed for the particular job on which the machine is used. There are four of the holders, corresponding to the number of indexing movements, mounted upon the table in such manner that they may swing in two planes; in effect a set of gimbal-rings that constrain the work only against rotation, allowing it to be guided freely in other respects by the lap. Each holder accommodates three pieces of work, to be lapped simultaneously.

The laps, of which there are three, are held loosely to the lower ends of the respective spindles by threaded rings and are positively driven by means of interlocking lugs. The object of this method of holding the work and the lap is that the latter is made to rotate with respect to the former, yet both are free to float and thus adapt themselves to each other without imposing lateral pressure. The laps are made of cast iron; each in three longitudinal sections that when combined present a tapered bore to the correspondingly tapered ends of expanding-rods which pass through the hollow spindles.

The machine is chain driven by means of an electric motor mounted upon a bracket at the rear of the base. Within the base is a constantly-running horizontal shaft that drives, through a train of change gears, a larger gear upon the hub of which is a Conway one-revolution clutch. A cam upon the back of this gear oscillates at fixed amplitude a lever and pawl to engage a large-diameter ratchet wheel the teeth of which are partly covered by an adjustable shield.

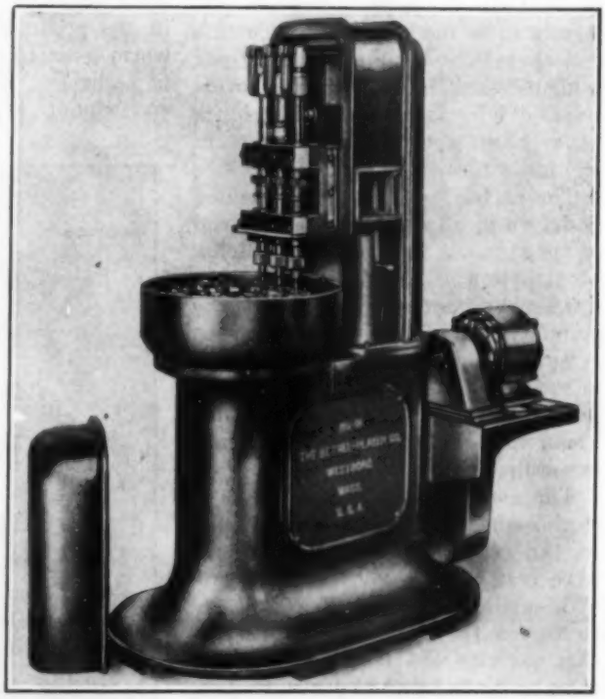
The ratchet wheel thus receives an intermittent motion the rate of which is varied according to the number of teeth exposed by the shield. The time of revolution of this wheel determines the cycle time of the machine, which may be set for any period from 20 sec. to 1 min. by adjusting the shield to expose a greater or lesser number of teeth of the ratchet, and for longer periods by altering the ratio of the change gear train.

The ratchet acts upon the Conway clutch by lifting a spring-loaded plunger through a definite distance, upon completion of which the plunger releases the clutch and is immediately returned to starting position by the pressure of its spring to await the next revolution of the ratchet wheel.

The clutch sets in motion a secondary shaft which is connected through a Geneva movement to the work table to rotate the latter through one-quarter of a turn. Also operated by the one-revolution shaft are two cams, one of which lowers the table and work away from the laps during the instant of indexing and returns it to working position upon completion of the movement while the other withdraws the expanding-rods and returns them to re-expand the laps after the latter have entered the holes of the work.

The positive withdrawal of the expanding-rods, only, is effected by this cam, which then passes from under the supporting roll and allows the rods to settle by gravity as the lapping proceeds. Weighted levers, the weights of which are adjustable by sliding them to or from the fulcrum point of the lever, bear upon the upper ends of the expanding-rods to force the tapered ends into the bores of the laps to expand them, and thus the rate of lapping is to a certain extent determined by the position of the weights upon the levers. An adjustable stop limits the downward movement of each lever and thus governs the size of the lapped hole.

The lapping spindles are rotated continuously at high speed by suitable gearing, and also have a continuous and comparatively slow reciprocating motion through a limited range. A uniform-movement cam, driven at greatly reduced speed through a train of change gears from the spindle drive-shaft, actuates the endwise movement, the amplitude of which may be adjusted to any range from ¼ in. to 1 in., and its rate with relation to the rotative speed varied by altering the ratio of the change gear train.



Bethel-Player No. 1-H Hole-Lapping Machine

The cycle of the machine includes presentation of the work to the laps

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by raising the table, lapping the holes to size while the indexing mechanism of the table remains idle, lowering the table to withdraw the lapped work and indexing it to present new work to be lapped. At the proper moments of the cycle the laps are collapsed, and are re-expanded in the new work. The operator's duties consist only of unloading and reloading each work-holding fixture as it is presented to the loading position.

The machine here shown is intended only to lap previously ground holes in hardened work. A modified design of the same machine may be furnished to lap the bores of automobile pumps and high-pressure rotary pumps. This machine weighs 2,500 lb., and occupies a floor space of 3x5 ft., approximately.

Schuchardt & Schütte Improved Gear Hobbing Machines

The improved Schuchardt & Schütte gear hobbing machine shown in the accompanying illustration has been placed on the market in the United States by the George Scherr Co., 142 Liberty St., New York, N. Y. The machine has been redesigned throughout to permit heavier demands to be made upon it. To this end there has been made a 20 per cent increase in weight, and oversized driving members and shafts have been provided in order to eliminate torsion.

The cutter spindle of the machine is driven by means of helical instead of spur gears. It is of three-bearing construction and is equipped with a flywheel mounted directly on the spindle. The flywheel need not be removed for any class of work. It is claimed that this results in a improvement of the finish of the work because the cutter will run more smoothly.

The cutterhead is rigid and close to the upright. To take up any play in the unit, adjustable taper gibs have been provided. The casting is of a semi-circular design and nearly envelopes the hob. This construction permits the bearings to come close to the hob and to prevent vibration of the arbor under heavy cuts. Both bearings are tapered and adjustable for wear.

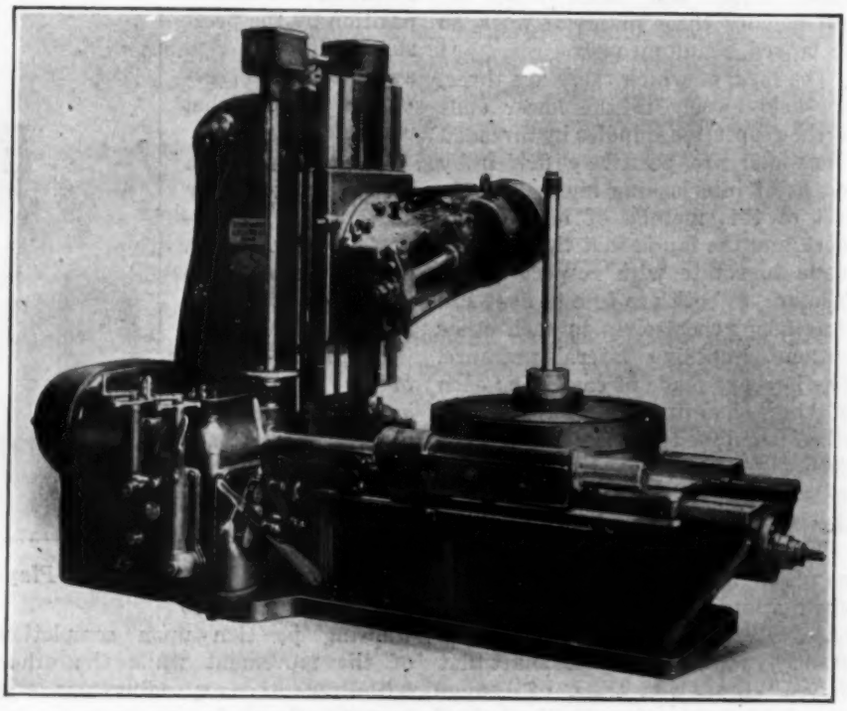
The ways of the bed are flat and are wide in construction. The carriage is firmly supported close to the spindle. The table bearings consist of V-shaped ways, a flat bearing and a cylindrical bearing. This construction is designed to prevent vibration and sagging of the table under heavy cuts. For cutting pinions with their shafts the table has a large bore and the carriage feed screw is offset so as not to obstruct the bore. The table, dividing wheel and work run in a continuous bath of oil, which is hermetically sealed to keep out all chips or dirt.

The dividing work gear is directly under the table and of practically the same diameter. Special care is taken in the production of the worm and worm gear to secure a high degree of accuracy. The worm is hardened and ground. It runs against hardened steel washers and has provision for adjustment.

All control levers are within convenient reach of the operator. The changes of speed and feed are obtained through gear boxes. The differential and feed gear box in front of the column provides nine different changes of feed that can be made while the machine is running and in operation. Changes of feed are also readily available when cutting helical gears, either right or left hand, without necessitating the exchange of gears.

Stops for the vertical feed to the cutterhead and horizontal feed to the table trip the feed automatically. Rapid power traverse is provided both for the cutterhead and for the table. Hand adjustment for the cutterhead is secured by means of a handwheel on top of the feed gear box and for the table by means of a crank at the face of the bed. Quick return of the cutterhead is independent of the feed mechanism, therefore, when cutting helical gears in two cuts the rapid return is used without losing the lead of the spiral. The rapid traverse and feed mechanisms are automatically locked against simultaneous accidental engagement.

The drive can be either by single pulley or by individual motor through the quick change gear box at the rear of the column. This box furnishes eight instant changes of cutter speeds. To secure a maximum of constant power and to eliminate



Schuchardt & Schütte Improved Gear Hobbing Machine

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vibration, additional flywheels are placed on the main horizontal and vertical driving shafts.

A pump furnishes a full supply of coolant. The index, feed, and differential gears are automatically oiled by a special lubricating device. The feedscrew for the cutterhead is supported by means of a bearing on the top and the bottom and close to the guides. As a protection against chips the feedscrew to the table is housed in telescoping tubes. The column has sliding guards below the cutterhead.

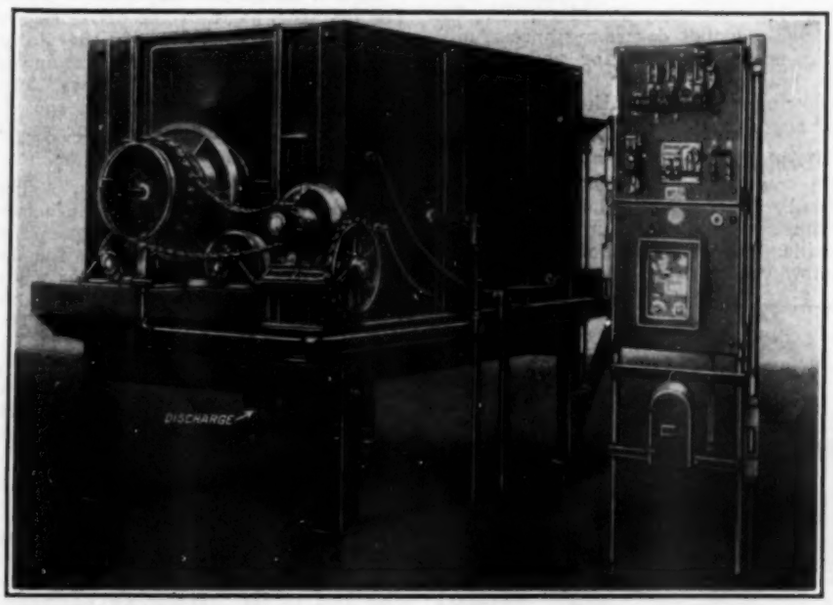
The machine can be equipped with a special tangential feed cutterhead for producing wormwheels by means of a tapered hob. The latter can be used also for cutting spur gears as well as helical gears with an angle up to 15 degrees.

Rockwell Electric Revolving-Retort Furnaces

Electric furnaces of the revolving-retort type illustrated have been added to the line of the W. S. Rockwell Co., 50 Church St., New York, N. Y. The machine illustrated is designed especially for annealing non-ferrous metal parts and has a capacity ranging from 1,500 to 2,000 lb. per hour, according to the weight, thickness and size of the individual pieces.

The parts to be heated are delivered in bulk to a hopper at the charging end and fed, automatically, into an alloy metal retort through which the pieces are moved by means of a spiral toward the discharge end. The discharge is through an opening which can be seen on the under side of the machine near the front end. Cooling by quenching is accomplished in the same manner with a rotary quenching tank in order to retain the principle of individual exposure.

The retort is chain driven and mounted on four roller wheels, two at each end. The two wheels at the discharge end of the machine are flanged in order to guide the revolving retort. A gear reducer which can be seen at one corner of the discharge end carries the chain pulley. Four angle-iron pedestals support the machine. All electrical connections are carefully insulated and protected.



Rockwell Electric Revolving-Retort Furnaces

A control panel especially designed for use with the machine carries the temperature regulating instruments and switches.

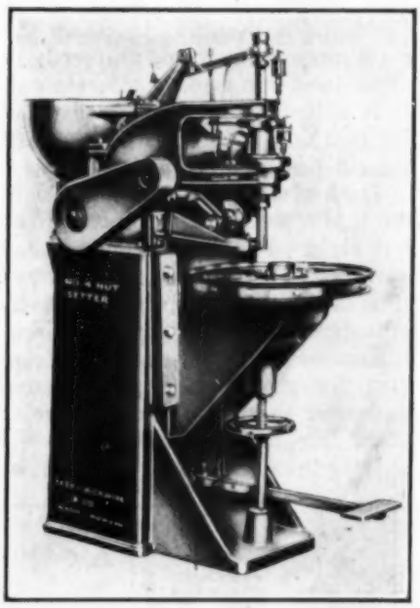
The connected load for this type of furnace ranges from 75 to 125 kw., according to the capacity and the temperature, which is held within close limits by means of the automatic control device.

For heat-treating steel products, similar furnaces are available.

Teer, Wickwire & Co. Nut Setter, No. 4

The No. 4 high-speed nut setting machine, shown in the accompanying illustration, has been placed on the market by Teer, Wickwire & Co., Jackson, Mich. As shown, the machine is set up to put the nuts on automobile wheel hubs but it is adaptable to any assembly, requiring nuts, that can be conveniently moved under the spindle.

The hopper automatically selects the nuts with the proper face up and delivers them to a trough. From here they pass to the wrench head at the end of the spindle. The nuts are forced into the spindle one at a time, as needed, through an opening that admits them when the spindle is in the up position. A pusher inside the spindle forces them into the lower end of the socket wrench. The pusher serves also as a solid backing for the top of the nut and prevents cross-thread starting.



Teer, Wickwire & Co. Nut Setter, No. 4

The operator lines up the screw beneath the spindle to receive the nut and depresses the treadle. The

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spindle then comes down and, at the same time, starts rotating at a high speed. The tension at which the nut is screwed up on the threads can be adjusted by means of a friction clutch. The treadle is then allowed to return and the friction clutch is disengaged. The spindle returns to the up position and receives a new nut. The operation can then be repeated.

The No. 4 machine will handle nuts ranging in size from $\frac{1}{16}$ to $\frac{1}{2}$ in., inclusive, and it can be converted from one size to another in less than two minutes. The machine is driven by means of a 2-hp. electric motor.

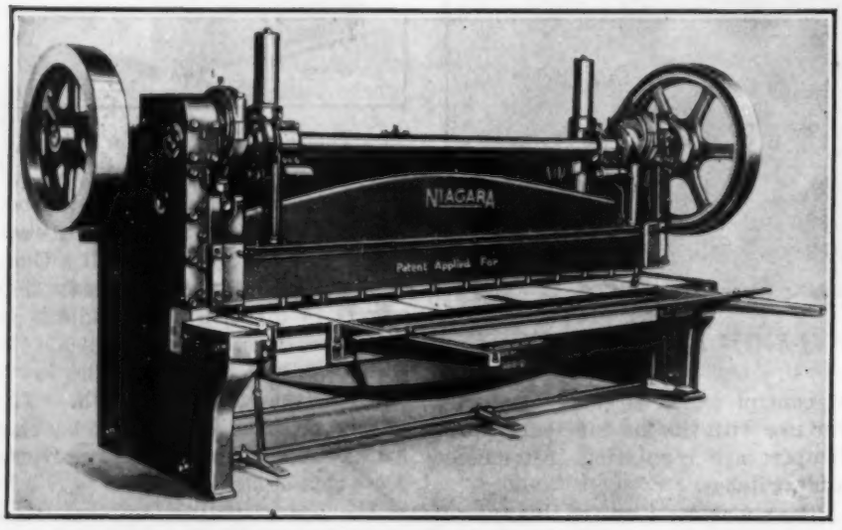
Niagara Squaring Shear Holddown

A holddown for use on its medium capacity squaring shears has been developed by the Niagara Machine & Tool Works, Buffalo, N. Y. The holddown is designed to clamp the sheet more securely and uniformly in order to obtain a more accurate cut. It is automatic in its operation and is timed to grip the sheet firmly until the cut has been completed.

The horizontal member of the holddown is a steel channel that is light but rigid. It is guided on finished surfaces at both ends. Each foot of the device is independently self-adjusting for wear and different thicknesses of material. Its construction provides for the accommodation of sheets with kinks, dirt or other foreign matter, and for sheets shorter than the length of the shear. Varying or uniform pressure can be secured because of the independence of the adjustment of each foot. If desired, a greater pressure on the ends of sheet can be secured than the pressure at the center.

The two cams that operate the holddown are on the main shaft of the shear, close to the heavy center bearings. The cam rollers are of hardened steel and run in an oil bath. The levers actuated by the cams close a toggle so that little effort is required to impose a considerable pressure on the holddown. The closed toggle links bring the holddown into play and transmit the pressure stresses directly to the housings. When the toggle is broken after the cut, the holddown is returned by springs. The springs are of the compression type and are completely incased.

The holddown is being furnished for shears operating on sheets of No. 14 gage and heavier where the cutting length is 8 ft. or longer.



Niagara Squaring Shear Holddown

Trade Catalogs

Milling Machines. The Ingersoll Milling Machine Co., Rockford, Ill., has issued a leaflet describing special milling machines built for railroad use. Several illustrations are presented showing typical operations in this class of shop.

Drills, Electric. The Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill., has published a leaflet on the Thor universal electric drills. Many illustrations are used to show various applications of this tool. A complete list of sizes with brief specifications is given.

Grinding Machines, Surface. The Blanchard Machine Co., 64 State St., Cambridge, Mass., has published a leaflet describing two operations on its surface grinding machine. In the first instance a brass gate valve disk is being finished, while in the second refrigerator compressor valve plates are being ground. The leaflet is illustrated.

Straightening and Bending Rolls. Kane & Roach, Syracuse, N. Y., has issued a general catalog on its straightening rolls, bending rolls, and cold roll-forming machinery. The catalog contains forty-four 8½x11-in. pages, and the presentation is largely pictorial with brief descriptions of the principal features of the machines. In addition to the machines themselves, several pages of photographs are included showing various types of machines in actual use in the shop.

Pamphlets Received

Elevator Specifications. For the use of architects and engineers, the Warner Elevator Mfg. Co., Cincinnati, Ohio, has published a booklet on elevator specifications. The bulletin gives the exact language in which specifications should be made covering the various parts of elevator equipment. The presentation is in the imperative mood. For instance, some of the divisions are headed as follows: "Specify the Motor as Follows; Specify Full Automatic Push Button Control as Follows," etc. Under these headings detailed specifications are given, classified for ready reference.

Engineering Achievements. The Westinghouse Electric & Manufacturing Co. is about to publish a pamphlet on its engineering achievements for the year 1926, in which the advances made in the numerous fields covered by this company are briefly touched upon. The bulletin contains forty-four 8½x11-in. pages and is profusely illustrated by photographs. The subject is divided under the broad heads of generation and distribution of power, turbines, condensers and stokers, transportation, the industries, illumination, radio, and miscellaneous subjects.

Export Trade. The National Foreign Trade Council, India House, 1 Hanover Square, New York, N. Y., has published the first of its fact-finding pamphlets in foreign trade entitled "The World's Export Trade Recovery From the War." The information is largely statistical and is condensed into three pages. In addition, a comparative table of exports from 72 countries for the two years, 1913 and 1925 respectively, is appended. Other pamphlets are in preparation. The series is intended to encourage American foreign trade.

NEWS OF THE WEEK

Body Colors and Engine Refinements Feature 1927 Automobile Show

Smaller cars with higher power introduced

A STRIKING feature of the 27th Annual Automobile Show in New York was the predominance of color in bodies. From the solid and sombre hues that seemed to be a part of mass production, we have blossomed into fancy colors, not alone but in combinations that please the eye and likewise require less dusting.

Another feature is the unmistakable trend to smaller cars and to more cylinders. The small car situation, however, has changed. Instead of a car where low price and reliability are the only considerations, the small car is coming to mean shorter wheelbase for easy parking, better bodies for comfort and satisfaction and engines that can show 40 to 50 miles per hr. without annoying vibration. This has resulted in the growth of six-cylinder engines in the smaller cars, and of eight-in-line engines in cars where six cylinders were formerly considered as the last word.

More Small Cars

All of the 44 cars on exhibition show signs of being alive to the competition that is increasing steadily. Makers of long standing are adding smaller cars to their line, from the two "Whippets" of Overland to the small 8-cylinder Marmon. Franklin, that was formerly one of the "high" cars on account of full elliptical springs, shows a sport sedan that is only 65 in. from road to roof. Reo, that has always been ultra-conservative, has abandoned the F-type engine, lowered its body and adopted a catchy name for its product. On the other hand, Hudson and Essex have taken up the F-type engine as being superior to the "L" head. Such difference of opinions add zest to the problems of engineers and confusion to buyers.

Some cars which were advertised as being the last word in 1926 have quietly disappeared and have been replaced by others to which the same adjectives are applied. The only satisfaction to the buyer is that automobile construction has now reached the point where it is practically impossible to buy a really poor car, for regardless of price, automobile value today is nearer 100 cents on the dollar than that of any commodity in general use.

The tendency seems to be toward smaller and higher speed engines of six and eight cylinders, and eight-cylinder engines are now to be found in a few cars that sell for less than $1,500. Strange to say, these are for the most part on cars that are assembled from standard units. This indicates that some of the management methods of car assemblers can perhaps be studied to advantage.

Greater care is being shown in details of construction, of engines, chassis and bodies. Air and oil filters are much in evidence, even on low cost engines. Vibration dampeners seem to be growing in popularity in the effort to iron out rough spots at certain engine speeds. Longer life is being built into engines and cars than ever before and is being capitalized by builders whose cars have an enviable reputation.

Fuel Economy Stressed

Gas mileage is being stressed by some and remarkable records cited. But the fact remains that the increasing power that is being built into nearly every car must prevent any appreciable decrease in gasoline consumption under ordinary driving conditions. It is questionable whether some of the present high powers are warranted, in view of the legal speed limits on nearly all highways.

Sleeve-valve engines are receiving more attention, a striking example being that of the new 9-cylinder radial airplane engine exhibited by Continental Motors. This is a single-sleeve engine of what is known as the Argyle type, having cylinders 4½x5½ in. and developing 220 hp. at 1,800 r.p.m. The displacement is 787.25 cu.in. and the engine weighs 475 pounds.

Steel Bodies Remain

In spite of the attempts to introduce fabric bodies—and it is claimed that their use is growing—the all-steel body keeps adding new customers. There are five new users announced at this time, all well known cars, and the steel body makers are naturally highly pleased with the increasing use. Closed bodies continue to grow in popularity, reaching 74 per cent of 1926 production.

Four-wheel brakes are also growing in popularity, even some of the smaller cars using them as standard equipment. Both mechanical and hydraulic brakes are included in this increasing application, the former type predominating in number, due partially at least to the lower cost. Balloon tires seem to have been universally adopted.

Coupled with the greater variety of colors is the increasing number of body styles to be found even in the lower priced cars. Just how far this is compatible with economical production is something of a problem. On the other hand, it is quite possible that a larger variety of bodies may reduce sales resistance and decrease sales costs, to a greater extent than manufacturing costs are increased. At any rate, they are evidently considered necessary to maintain the volume of business at the 1926 level, for few seem to anticipate a material increase in 1927. The replacement business is likely to decrease as car life increases, and "second" car sales are looked to as an offset to this decrease.

Twenty trucks and four taxicabs are also shown, while there are 49 exhibitors of machines and devices for the proper equipment of service stations, repair shops and garages. Fortunately for car owners, there is an improvement in the servicing of cars, whether by service stations or local repair men, due in part to the increasing use of equipment of this kind.

Accessories of all kinds—and new ideas are being devised all the while—add to the interest of the exhibit. And there are 148 such exhibitors. Many items that were accessories a few years ago are now a part of standard equipment, in the desire to make cars as delivered, more complete and satisfactory in every way. It is a far cry from the days when a windshield, lamps and tops were extras, to shock absorbers, bumpers, cigar lighters and vanity cases being a part of stock equipment.

1927 a Good Year

The industry continues to grow and there is every indication of 1927 being a good year for the best known builders. A few figures of 1926 are of special interest.

Total production passenger cars	3,950,000
Total production trucks	530,000
Wholesale value of passenger cars	$2,622,400,000
Wholesale value of trucks	$434,500,000
Tire production	63,000,000
Average retail price of cars	$886
Average retail price of trucks	$1,090
No. of people in motor vehicle and allied lines	3,500,000
Passenger cars in United States	19,520,000
Motor trucks	2,810,000
Motor buses in use	80,000

Submit Standards for Approval

The joint committee of the Society of Automotive Engineers and the American Society of Mechanical Engineers has transmitted to the American Engineering Standards Committee a proposed standard on wrench head bolts and nuts and wrench openings for the approval and designation as a tentative American standard.

Foreign Trade in 1926 Greatest in History

The year 1926 witnessed a continuance of that rapid expansion in our exports of manufactured goods so conspicuous for many years past, and particularly since the World War. The prospects for further growth in this direction seem highly favorable. This is the gist of a report just issued by Dr. Julius Klein, director of the U. S. Bureau of Foreign and Domestic Commerce. The following paragraphs cover the important phases of this trade.

If 1927 should bring any lull in the unprecedented prosperity which we have enjoyed since 1921, such as is prophesied in some quarters, we may expect a marked increase in export activity. The intelligent appreciation of foreign trade as a stabilizer of business is far more prevalent today than ever before. The past five years have witnessed an impressive growth in the "export sense" of American business, the benefits of which we shall observe whenever the next sag may occur in our business curve.

Favorable Export

Quite apart from this relationship between domestic and overseas business, there is evident a decidedly favorable outlook for the export of our manufactures because the world as a whole is enjoying fairly stable and gradually improving economic conditions. Furthermore, our own industry, constantly gaining in efficiency, is able, despite the highest wages in the world, to produce many classes of goods at lower cost than prevails elsewhere, and to produce goods of superior quality which appeal strongly to the buyers of every land.

In contrast with several years preceding, the money value of the total exports of the United States in 1926 declined slightly, being in the neighborhood of $4,800,000,000 or about 2 per cent less than in 1925. Quantitatively, however, the exports increased somewhat and were larger than in any other year in our history, with the possible exception of 1919. Careful computations show that for the first nine months of 1926, eliminating the effect of price variations exports were 4 per cent greater than during the corresponding period of 1925, and it is likely that the year as a whole will show a still greater increase.

In contrast with the decline in the total value of American exports resulting from lower prices, our imports have shown an increase. As a consequence, the so-called favorable balance of trade, that is, the excess of merchandise exports over imports, has fallen to a figure somewhere between $300,000,000 and $350,000,000. The balance will probably prove to be the smallest since 1910, and contrasts with an annual average of $947,000,000 for the five years 1921 to 1925.

Notwithstanding the diminution in our excess of merchandise exports, which usually indicate the flow of funds available for investment abroad, the new investments in 1926 were probably the largest since the war. They totaled more than one billion dollars.

It might perhaps have been expected that the large payments thus made abroad would result in an outflow of gold. Such, however, was not the case. We actually imported considerably more gold than left the country; the excess between $80,000,000 and $100,000,000.

Of the five great classes into which export trade is divided, finished manufactures alone showed an important increase in value in 1926. The increase was in the neighborhood of 8 per cent over 1925, about 53 per cent over the calendar year 1922, and nearly 65 per cent over the fiscal year 1921-22 which marked the bottom of our postwar trade. This is an altogether gratifying showing.

The value of imports in the year just closed was in the neighborhood of $4,450,000,000, or about 5 per cent more than in 1925, nearly 80 per cent greater than in 1921, and nearly two and one-half times the largest pre-war value—that in the fiscal year ending June 30, 1914. When adjusted for price changes, the volume of import trade in 1926 is revealed as much the largest ever attained; it exceeded that of 1913-14 by at least 60 per cent.

Taking it altogether, therefore, our foreign trade in 1926 was highly satisfactory. The statistics show clearly the further strengthening of our position in world markets for manufactured goods, and the high general prosperity of the country as reflected in increased imports. The only weak spot in the situation is the relatively low price of some of our agricultural exports.

Aircraft Designers in Navy Competition

Designs have been submitted by fourteen aircraft designers and contractors to the training plane competition board appointed by the Secretary of the Navy to consider designs for the purpose of selecting for the Navy a standard training plane. The time for submitting designs closed on Dec. 21, and assuming that all designs submitted before that time had reached the Navy Department, the Bureau of Supplies and Accounts has inspected the plans entered and turned them over to the board for its consideration.

The following companies submitted bids and designs for training planes:

Curtiss Aeroplane and Motor Co.; Thomas Morse Aircraft Corporation; Aerial Service Corporation; Kentucky Aircraft Corporation; Boeing Airplane Co.; Consolidated Aircraft Corporation; Sikorsky Manufacturing Corporation; G. Elias & Bros., Inc.; Huff Doland Airplane, Inc.; Buhl Verville Aircraft Co.; Glenn L. Martin Co.; Eberhart Aeroplane and Motor Co.; Charles Ward Hall, Inc.; The Douglas Co.

The designs will be judged on four points: Performance, with a weight of 35 per cent, includes stability and maneuverability in the air, on land, and on water; the ratio of high speed to low speed, and the rate of climb to 3,000 ft.

Upon the selection of a design the procurement of the training planes will be carried out in accordance with the Act of Congress of July 2, 1926.

British Expert Will Address S.A.E.

Thirty addresses on automotive engineering topics have been scheduled in the program that has been arranged for the four-day meeting of the Society of Automotive Engineers to be held in Detroit Jan. 25 to 28. The meeting comes during Detroit automobile show week and between the New York and Chicago national automobile shows.

Ten technical sessions will be devoted to employee training, body construction and painting, production methods, detonation or engine knock, research work, small car characteristics, transmissions, and chassis. One afternoon is reserved for the "mystery session," the subject of which is being kept a secret.

The meeting will end with a carnival on Friday night. More than 700 reservations for this indicate that the capacity of Oriole Terrace will be taxed.

Among the addresses of special interest scheduled for the technical sessions are one on English light cars, by Alan Fenn, who is coming from England especially to present it; one on the construction of light, flexible fabric bodies, by Charles Weymann; one on the use of X-rays for revealing defects in castings and other metal parts, by G. L. Clark, of Massachusetts Institute of Technology; one on plating with chromium, by W. N. Phillips; one on color harmony in automobile painting, by Arthur S. Allen; a complete description of the Constantinesco variable torque transmission, by R. K. Jack, who is coming from Glasgow for the purpose; and one on the training of employees at the General Motors Institute of Technology, by Albert Sobey.

Many subjects will be illustrated with lantern slides and some motion pictures, and several research addresses will be accompanied by actual demonstrations with apparatus.

Engineers Building For Chicago

Plans for the construction of a twenty-five story office building to provide a home for the Western Society of Engineers have been announced in Chicago. The structure will be erected at Wells St. and Wacker Drive, and will cost approximately $4,000,000. The building will contain a big auditorium capable of accommodating the annual meeting of the society and other engineering organizations; also accommodations for the technical library of the society, together with lounging rooms, dining rooms and recreation rooms.

Request Standardization

At its meeting on Dec. 10 the council of the American Society of Mechanical Engineers voted to request the American Engineering Standards Committee to authorize the organization of a sectional committee to undertake the standardization of the dimensions and material of wrought iron and wrought steel pipe and tubing. The council pledged the assistance of the society in carrying on this work.

France Would Develop Internal Air Lines

Increased attention is being given in France to projects for a series of internal aviation lines, connecting principal cities, states a report to the Department of Commerce. With Chambers of Commerce actively interested, a study is under way of lines to connect Geneve and Bordeaux, via Lyon and Clermont-Ferrand; Paris and Douai, and Toulouse and Paris.

A recent visit of French authorities to Germany, and the report they brought back of the network of internal air lines which cover that country from one end to the other, have apparently aroused the French to new efforts. Success of international "trunk" lines, of which France has four, is pronounced dependent upon an efficient system of "feeder" lines.

Welding Conference at Purdue

More than 200 industrial executives attended the second annual conference on welding under the auspices of the engineering extension department of Purdue University held in LaFayette, Ind., last month. At this conference there were demonstrations of electric, thermit, and oxy-acetylene welding and lectures by welding experts.

Prof. W. A. Knapp, of Purdue University, presided at the meetings and introduced the following speakers: A. G. Bissell, welding engineer, Westinghouse Electric and Manufacturing Co.; W. M. B. Brady, General Electric Co.; T. W. Greene, Linde Products Co.; J. H. Deppeler, Metal Thermit Co.; R. E. Kinkaid, Lincoln Electric Co.; Karl Haas, Una Welding and Bonding Co.; E. E. Thum, Oxweld Acetylene Co.; H. L. Maxwell, Purdue University; J. W. Swift, American Brass Co.; R. L. Lerch, Haynes Stellite Co.; M. S. Card, editor, the *Welding Engineer*, and J. L. Bray, Purdue University.

Foreign Traders in Detroit in May

Detroit will welcome the foreign traders of the United States this year at the fourteenth national foreign trade convention to be held on May 25, 26 and 27, it was announced last week by James A. Farrell, chairman of the National Foreign Trade Council.

The Detroit convention, in the midst of one of the most successful and important business communities in the country, will afford a solid opportunity, Mr. Farrell declares, for thoughtful examination of the present condition and future possibilities of foreign trade; to stimulate co-operation in the best use of our resources and to secure the judgment of practical and experienced traders on present problems. This meeting will be the first foreign trade convention to be held away from the seacost since 1921. Plans are being made to accommodate a gathering of more than 2,000 delegates, due to Detroit's situation within one night's journey of three-quarters of the great industrial centers of the country. The foreign trade problems of the automobile industry will have a leading place on the program and thirteen other great industries of the country will also figure largely in the convention's practical foreign trade setting.

Norton Film Shows Grinding Practice

At the monthly meeting of the Boston branch of the National Metal Trades Association, on Jan. 5, the Norton Co., of Worcester, Mass., showed for the first time a new industrial motion picture film entitled "The Age of Speed." The purpose of the film is to educate the general public on the subject of grinding. Comparison is made between old and modern production methods in many industries, such as the textile, agricultural, wood-working, and paper and pulp.

A considerable part of the film is devoted to the manufacture of the automobile, truck and tractor, featuring many operations that will interest mechanics, as well as the general public. Some of the more interesting views are scenes in the grinding departments where camshafts, crankshafts and other parts are being finished. All through the film it is emphasized that modern accuracy in manufacture, rapid production and high speed are the results of the development of grinding.

Cleveland Engineers Open Exhibit

An exhibit of engineering equipment and materials was established in Carnegie Hall, Cleveland, on Jan. 12, under the auspices of the Cleveland Engineering Society. Machinery and equipment used in manufacturing and building fields will be on display in a continuous exhibit which will be changed from time to time.

More than forty of the leading manufacturers in the country have sent samples of their products to be placed in the exhibit and there is presented a complete collection of tools, gages, machinery and materials. The center of the exhibit hall has been reserved by the society as a place to hold meetings, both of local engineering bodies and national technical societies. There will be a change in exhibits each month, and each change will see some particular product as the feature of that period. Machine tools are shown this month.

The exhibit is under the management of Carlton R. Sabin, secretary-manager of the society. Theo. H. M. Crampton is chairman of the exhibit.

The Cleveland Engineering Society has also instituted a short evening course in engineering to study standardized practices. This course runs from Dec. 15 to Feb. 16. Other engineering bodies co-operating in this course are the American Engineering Council, A.S.M.E., American Plan Association, and the Cleveland Chamber of Commerce. The course includes a series of lectures combined with visits to several industrial plants in the vicinity.

Navy Saves on Repairs by Own Forces

A high standard of self-maintenance by the ships of the United States fleets is resulting from the technical training now a part of regular naval education given to both officers and enlisted men, the Department of the Navy has announced.

During the past year major repair work accomplished within the United States fleet exceeded that of previous years. This can be accounted for in large measure, it was stated, by the fact that training for officers is provided at post-graduate schools at the Naval Academy, and that an average of about 1,600 enlisted men are kept under training annually in service schools ashore specializing in technical vocations.

That this training is bearing fruit is verified not only by the quantity of major repairs accomplished within the fleet, but also by the type of repair jobs completed. Such major repair work was accomplished as the retubing of boilers and condensers, the lifting of turbines, installation of pumps and machine tools, renewal of propellors, large welding jobs ordinarily performed by the navy yards, and alterations to complex radio installations, besides other important work.

The value of the material worked into repairs and alterations by ships' forces during the past year amounted to $1,404,000. If this material had been installed by navy yard or by contract labor, the equivalent labor cost would have been a little more than $3,800,000.

Notwithstanding this relief afforded navy yards by the ships afloat, the work load of navy yards for repairs of the ships increases from year to year. For the past year, this amounted to an increase over 1924 of more than a half million dollars. This is accounted for by the increased age of vessels in active service. These ships require increased repairs and alterations to maintain them in efficient operating condition.

"Electrical West"

On January first the *Journal of Electricity* changed its name to *Electrical West*. Serving as it does the electrical industry of the eleven Western states, the new name will more closely define the field and the function of the paper. Beginning with the January, 1927, issue, *Electrical West* will be published monthly, on the first of the month, instead of semi-monthly as in the past. The *Journal of Electricity* was founded in 1887.

Raise Patent Fees

Senate Bill No. 4956, introduced by Senator Metcalf, if enacted into law would provide a new schedule of fees for services rendered by the Patent Office. This would be done through an amendment to Section 4934 of the Revised Statutes, and the schedule would become effective three months after approval of the Act.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

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THE business news that has filled the papers during the past week may be described as the exhaustion of superlatives insofar as it records the achievements of 1926, and as the conventional expression of faith when it looks toward 1927.

The new heights of production that were achieved in 1926 ought to have made everyone individually prosperous, but the faster the country's business operates the more difficult it is to keep in balance and if any machine in the shop has been producing more rapidly than its fellows it will have to slow down until the others catch up.

Therefore, most of the expressions of faith in the future are rightly tempered by emphasis on the necessity for caution. And while those who wield the strongest influence on public opinion are properly optimistic, among the nooks and corners of the year-end statements are many suggestions that a breathing spell and a period of digestion in the early part of 1927 will be a benison.

For while our material blessings have been greater than ever before they have not been equally distributed. A few lines of verse written only a few days ago by a high school girl in Shreveport, La., have been reprinted throughout the South, and since they make such a wide appeal they probably express enough truth to justify publication here:

Eleven-cent cotton and forty-cent meat,
How in the world can a poor man eat?
Flour up high, cotton down low,
How in the world can we raise the dough?
Eleven-cent cotton and a carload of tax,
The load's too heavy for our poor backs;
We can't buy clothes, we can't buy meat,
Got too much cotton and not enough to eat.

This disparity in prices is the complaint of the grain as well as the cotton grower, and while the distress is by no means as acute or as universal as pictured, industry cannot be expected to go on making new records as long as such statements can be made with even approximate truth of our basic industry.

Agricultural self-consciousness in the United States, which is dormant even in the most prosperous times, was reawakened in 1921, has been acute ever since, and will continue to demand recognition until at least a gesture is made in its direction. Most close observers of Congress seem to think that neither the McNary-Haugen bill nor any other embodying the levy of an "equalization fee" upon a commodity can be passed and that a substitute encouraging and offering financial aid to cooperative marketing eventually will be adopted. Such a course would be more in accordance with classical economic principles but it would not provide the immediately higher prices that the farmers hope for. If that is the outcome of the present agitation, industry will have to fall back on "doing its own washing" to keep busy and it will likely follow for the present the more restrained pace of the last two months of 1926 than the headlong activity of the earlier part of the year.

In this there is no cause for dissatisfaction, for a serious or prolonged recession is unthinkable because inventories are well in hand and money is almost certain to continue abundant at low rates.

In these circumstances no great readjustment of our mental attitude seems necessary because salutary caution and an earnest search for stability have determined most business policies during the past two years. If they are continued there is little occasion for worry although the exhilaration that comes from buoyant markets may be missing. The record of the week blends with this view. Grains have been down a little and up again with the "speculative expectancy" rather on the bear side. Cotton has been steady but cannot be expected to advance much more at present because there is so much that will be offered for sale if higher prices threaten acreage reduction. Sugar is momentarily a little easier and the statistical position is strong.

But rubber is more active and higher because a good many of the automobile factories started in at full production again promptly after New Year's and the steel industry, while at relatively low production, is looking for heavier railway buying than for several years. The policy of the roads is to buy when possible during recessions and many large construction projects are placed upon the same principle. The effect in stabilizing business is appreciable and the F. W. Dodge Corporation anticipates a building record that will be but little below last year.

The stock market has been irregular, suggestive of a whipping up of flagging energies by professional speculators and without other significance. The continued strength of the bond market and easy money suggests an impending parting of the ways in the trend of stocks and bonds.

In Europe the outlook for a New Year better than the old is distinctly bright. A number of countries have balanced their budgets and restored their finances to something like stability, and France and Italy seem about to do the same. Both countries are even now experiencing some of the pains of deflation.

WHAT'S DOING IN INDUSTRY

THE FIRST week of the new year has opened up auspiciously for manufacturers of and dealers in machinery and machine tools. Business held over from December was placed immediately after new books were opened for 1927, and the total volume all over the country was quite satisfactory. Inquiries continue to arrive in increasing numbers, indicating future buying.

CINCINNATI reports orders and inquiries in larger volume, with prospects bright for a good month. No special feature characterizes the Chicago market but many orders held over may be closed any day now. Detroit is marking time until after the automobile shows give the signal for production of motor cars. Business is picking up slow in Indianapolis, automotive and wood-working factories placing orders for shop equipment.

NEW ENGLAND is enjoying a prosperous season, some railroad and export business furnishing a good start for the year. Inquiry activity is brisk in New York and enough orders have been placed recently to guarantee a good volume. Increased industrial activity in Canada assures the purchase of machinery and tools in the near future. Textile and general construction projects in the South are opening up new sales opportunities for machinery of all kinds.

WHILE most opinions on general business conditions are optimistic, there are many suggestions that a breathing spell and a period of digestion in the early part of 1927 will be a benison.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

NEW ENGLAND

The volume of inquiry mail now being received by machinery builders in the Connecticut section of New England and in western Massachusetts sustains the feeling of manufacturers that for the early part of the year, at least, there will be a large amount of business. Specifications cover contract material and new equipment, most of which is judged to be of the replacement variety. Already, orders which undoubtedly accumulated in the final month are being received. Some of this business, the larger part in fact, is for railroads. This is well scattered.

Production machinery for export delivery is now being bought, and there is a demand for early shipments.

Small tool manufacturers indicate that orders are being received in substantial volume, but it bears resemblance of hand-to-mouth buying.

A favorable condition for the trade appears in Hartford, Conn. The Royal Typewriter Co. will immediately put on about 400 skilled mechanics. This will make a working force of about 2,900 employees.

CHICAGO

The first week of 1927 finds the machine-tool market without special feature. Dealers report sales as negligible, their activities being confined chiefly to taking care of orders received during December for delivery following Jan. 1. Inquiries are being received in sufficient number to encourage the belief that later on this month there will develop a satisfactory volume of business.

Automobile production is reported from the principal manufacturing centers as gradually speeding up to capacity output, a few plants having actually reached that stage. This is expected to furnish a good share of business in the near future. Dealers in used machine tools express the belief that for the early months of this year the demand for used tools will be larger than for some time past, basing this opinion on the fact that during the final months of last year buying by manufacturers of new tools was on a more liberal scale than for used machinery.

There is still considerable to be done before all inventories are completed and budgets for this year's requirements are made up, pending which time trade is not expected to show particular activity. A general feeling of optimism prevails in the machine-tool industry with respect to the present year's business, but it is not believed that this will develop along active lines until the year is further advanced.

SOUTHERN DISTRICT

Following a lull in holiday week inquiries have picked up steadily, and though few sales are yet being made, from the tone of inquiries it is apparent that a fair volume will be done this month. Dealers predict at least normal sales, and because of general industrial prosperity believe the second and third months of the year will be better than normal.

Inquiry is especially good for textile equipment, and as the industry plans a large amount of construction a record volume is in prospect.

Conditions are also improved in the wood-working field due to a large amount of new construction by furniture companies, mainly in Tennessee and North Carolina. Few sales have been made recently, though inquiry is brisk.

Railroads are doing some buying and will probably be active the next few months as there is a considerable amount of shop and terminal construction planned. At least a normal call is expected.

Garage and service station sales will probably be good, but hardly as large as the fore part of 1926 when a new sales record was established in this field.

Contractors' equipment and road-building machinery comprise two other lines that are expected to be active the first half of the year. Business with smaller machine shops has been quiet lately, but is beginning to show slight improvement, with the outlook fair.

CINCINNATI

Machine tool manufacturers and selling agents in the Cincinnati district report that the new year has started out in a most satisfactory way. Orders are increasing in number from day to day, and there is every indication of an increasing demand through succeeding months.

A considerable portion of the past week's business consisted of orders that purchasers had held up in December. The greater part of the week's orders called for replacements and single tools, coming from all sections of the country and well diversified as to sizes and types of tools.

The International Harvester Co. bought a few tools in this market in the past week and it is understood that more orders from this source are to follow. Sales to concerns in the automotive industries were confined to single tools and replacements, and railroads did a little buying here and there, but the greater part of the week's purchases were made by general machinists and miscellaneous industrial users of machine tools.

Inquiries are being received in increased numbers and because of this the outlook is regarded as being decidedly good. Machine tool plants are busy and production is being maintained at a good level.

DETROIT

The first week of January has been one of marking time in the machinery and machine tool industry in Detroit, as everyone is apparently waiting for the automobile shows to open and for the public to have a chance to show its preference for the various models.

While there are no large expansion programs scheduled for 1927, as far as the leading representatives of machinery manufacturers in Detroit can ascertain, the outlook last year was just about the same. A year ago no great extensions were planned but one thing lead to another until a number of big programs broke for the machine tool field. That a similar course of events may happen this year is the view of some leaders in the industry.

The re-employment of 150,000 since the first of January at the Ford, Dodge and other factories, where the annual inventories caused a temporary cessation of all manufacturing activities, has created a feeling of optimism among machinery representatives. Orders for new equipment have in many cases been temporarily held up until show time.

The demand at present is for special machines, except the few instances were standard equipment will suffice provided special attachments are available. Replacements are expected to be the biggest factor in the sales curve for the first quarter of 1927.

CANADA

A confident spirit prevails throughout the metal markets of the Dominion. Indications are that there will be a good demand for machinery and machine tools durlig the first half of the year. Reports of liberal specifications against contracts are already heard, and when the next couple of weeks have passed, shipping on a large scale is expected to be general.

The Canadian Locomotive Co. reports considerable new business. About 400 men are being taken on at the company's Kingston plant. The International Harvester Co., of Hamilton, is running at full capacity, with 3,600 people on the payroll, as compared with only a few last year at this time. The English Electric Co., of Canada, has secured the contract for the complete electrification of the Noranda Mines in northern Quebec. The contract includes transformers, motors, generators, etc.

It is altogether likely there will be considerable business coming from the railroads in the very near future. It is known that the Canadian National Railways contemplate the purchase of several new locomotives.

The iron and steel market is quiet at present, but much interest is being shown in the needs of the next few weeks. W. C. Franz, president of the Algoma Steel Corporation recently expressed the opinion that the iron and steel business in 1927 would be better than during the year just closed.

INDIANAPOLIS

Business remained rather quiet during the holidays, but since the first of the year the volume has shown expansion. Most of the industrials were closed at some time during the holidays for inventory. This naturally slowed down machinery and tool business. Since production has been resumed, however, inquiries are large and from varied sources. Buying has also commenced and continues at a fair rate.

Demand from the automobile factories is good. Both Marmon and Stutz are working virtually to capacity, with orders from their dealers indicating that the late winter and early spring production will shatter all previous records. The Marmon plant is very busy getting ready to show the new straight-eight small car.

Demand for special machinery from furniture factories is picking up. The same is true of the automobile body manufacturers. The furniture demand shows particularly well. Factories are ready for the two large shows and most of them have orders in such volume as to indicate pro-

duction will have to be kept to the limit. Demand for special machinery for lumber manufacturers also continues good, but the situation is uncertain.

Demand from the coal fields, both for machinery and tools, is good. The year has been the best for some time. A big slump is expected, however, when the time nears for the bi-annual wage settlements. Railroad buying is not changing, the volume is hardly as large as was expected, but it is more than at this time last year.

NEW YORK

Activity in this market has kept up a pace that is surprising to dealers and agents. During holiday week, when business usually slows down, there was a slight increase in both orders and inquiries. Some machinery was bought on old quotations, but there was a good proportion that was new. Paper activity is general, there being a widespread demand for information on high-production machines. Most of this inquiry is expected to materialize into actual sales within a few weeks.

Modern tools for increasing production are in chief demand. A feature of last week's business was the receipt of several good orders from industrial firms in California. Turret lathes, grinders and milling machines were placed. Other buying was diversified some purchasers being Western Electric, New York Central R.R., Wm. Sellers & Co., General Electric and the U. S. Engineering Repair Station. Present conditions in the market presage a good volume of orders for the month.

News of the Automotive Industry

H. M. Jewett was elected chairman of the board of directors of the Paige-Detroit Motor Car Co. W. S. Wheeler was named to succeed Mr. Jewett as president. Thomas Bradley and Henry Krohn were elected general vice-presidents and directors. The January production scheduled calls for about 100 cars daily.

P. L. Emerson, vice-president in charge of sales of the General Motors' Truck Co., states that as part of a nation-wide expansion campaign, a direct factory branch will be opened in Salt Lake City headed by Ben H. Richards, district representative in the territory for Yellow Cab and Drivurself divisions of the Yellow Truck and Coach Manufacturing Co., of which General Motors Truck Co. is a subsidiary.

The Hudson Motor Car Co. opened January with a schedule of 500 cars a day. Schedule is 11,000 for the month, to be increased the last week of the month by 250 cars a day.

Ford production in Canada during 1927 will greatly exceed that of 1926, according to Wallace R. Campbell, general manager and treasurer of the Ford Motor Co. of Canada.

Olds Motor Works has started the greatest production program of its history this month. During the past year, increased demand taxed plants to capacity and necessitated inauguration of a substantial plant and equipment expansion program. Work on this was started some time ago and the additional facilities are now in operation. With the start of the new year, new and additional machinery and equipment enables greater production in axle, motor sheet metal and several other departments. A new heat-treating plant has been erected that will double production of that department. Similar additions have been made to the chassis and final assembly lines and to the body building facilities.

Studebaker Corporation dividends for 1926, of about $10,000,000, were fully covered by earnings for the first nine months of the year and in addition there was nearly $2,000,000 left over for surplus, A. R. Erskine, president, informed stockholders in a recent statement. He says that the corporation had a net working capital of $41,000,000 on Sept. 30 and current assets of $53,000,000. Mr. Erskine stated that 1927, he expected, would be the most prosperous in the history of the business.

Reports received covering the sale of foreign assembled cars of American design during November from twenty-two branches of American (United States and Canadian) companies, indicate production and sales of 14,242 passenger cars, trucks and chassis, according to the automotive division of the Department of Commerce.

This November total surpassed that of October by 1,323; the number of American type cars assembled abroad in September, 1926, was exceeded by 5,728 units. It is particularly interesting to note that, despite the fact that the percentage of closed car production in this country is very high, of the passenger cars assembled during November in foreign branch plants of American companies about 83 per cent were touring cars and roadsters.

Combined exports of passenger cars and trucks from the United States during the first eleven months of 1926 increased in value by almost $5,000,000, according to the automotive division of the Department of Commerce. During this period the number of units exported amounted to 279,599 valued at $204,206,580 as compared with 269,414 units valued at $199,768,779 in 1925.

Although the "20th Salon de l'Automobile" in October proved a notable success, the last quarter of 1926 developed into the worst period of the year in the French automobile industry, according to advices to the Department of Commerce. Hopes had been aroused by the brisk domestic sales and record-breaking exports of the first six months of 1926, but the second half of the year saw business generally handicapped by exchange fluctuations, increased taxes and higher operating costs. It is now believed in France to appear certain that the production of cars and trucks by French manufacturers this year will be practically the same as in 1925—about 180,000 units.

Scotland Yard has announced that it is prepared to consider the application of any four-wheel braking system to licensed cabs and coaches in London. This announcement is of considerable importance to manufacturers and distributors of commercial vehicles. In the past it has been necessary to use buses, cabs and coaches in the London area, with brakes only on the rear wheels, in accordance with Scotland Yard specifications. For several years attempts have been made to secure a modification from Scotland Yard on this particular question but without success.

A paper giving the results of a series of tests on ten automotive ignition systems of radically different types has just been issued by the National Advisory Committee for Aeronautics. The work on which this paper is based was carried out at the Bureau of Standards, and included studies of both high-tension magnetos and battery-coil systems.

The results serve to indicate the performance which may be expected of magnetos and spark coils similar to those tested while in good mechanical condition.

Auxiliary measurements were made to determine the electrical constants (inductance, resistance, capacitance, current at breaks, available magneto energy, etc.) of the windings. It was found that the theoretical relations between these constants and the over-all performance of the apparatus were borne out by the experiments. This confirmation should enable the makers of such apparatus to put their designs on a more scientific basis.

Business Items

The Rogers Grinding Machine Co., of Litchfield, Conn., is changing the corporation name to Rogers Centerless Grinder, Inc.

The plant of the Warren Axe and Tool Co., at Dunkirk, N. Y., was destroyed by fire on Jan. 2. The loss is estimated at $100,000.

Tennant Bros., of Dallas, Texas, have been appointed sales representatives in that state for the Beaver Machine and Tool Co., of Newark, N. J.

The Atlanta Metal Products Corporation was recently organized and incorporated in Atlanta for the manufacture of metal products, by A. B. Cooper, M. D. Dexter, and others, of Atlanta.

James L. Mayer and Frederick E. Oswald announce the opening of a sales office for industrial engineering equipment at 332 So. La Salle St., Chicago. They are now representing the Dings Magnetic Separator Co. and the Saginaw Stamping and Tool Co.

The Southeast Supply Co., of Atlanta, distributor of Cleveland tractors and the Royal Road graders in Georgia, has moved to 322 Edgewood Ave., where larger quarters are provided.

The Foote Bros. Gear and Machine Co., announce the appointment of the Progressive Machine and Engineering Corporation, 1335 E. Franklin St., Richmond, Va., as district representative covering the state of Virginia.

The Mead-Morrison Manufacturing Co., of Boston, Mass., manufacturers of cranes, tractors, and similar equipment, announces the opening of a new Southeastern office in Atlanta at 209 Bona Allen Bldg., handling the Georgia, Alabama, Mississippi, Florida, South Carolina, North Carolina and Tennessee trade. J. W. Hodge is in charge of the new branch as district manager.

The Union Manufacturing Co., of New Britain, Conn., manufacturer of chucks, has purchased that part of the Franklin-Moore Co., of Winsted, Conn., having to do with chain hoists, blocks, trolleys and similar equipment. The Union company will continue the manufacture and distribution of these products. No change is contemplated at this time.

The Eastern Malleable Iron Works, operating plants at Bridgeport and Naugatuck, Conn., as well as the Vulcan Iron Works at New Britain, Conn., has acquired the Malleable Iron Co.'s plant on Myrtle St., New Britain. The amount of the purchase was not made public but the plant property is assessed at $542,000. William Waskey will continue as manager of the Malleable Iron Works.

The H. F. Holbrook-Henry Brewster Corporation, of New York, has acquired the land, plant and equipment of the Blue Ribbon Body Co., 1720 Fairfield Ave., Bridgeport, Conn. The company has plans for expansion, and has commissioned a builder to prepare plans for a one-story mill addition. It is planned to equip the plant to manufacture 800 custom automobile bodies and 600 bus bodies yearly.

The Diamond State Fibre Co., of Bridgeport, Pa., announces that beginning with this month the Celoron Co., a subsidiary, will be operated as a separate division of the Diamond State organization. Within a week the New York office of this company will be moved to 200 Hudson St., where a complete service shop and plant for the manufacture of fiber specialties has been established. The new plant will be known as the Celoron Co. Division of the Diamond State Fibre Co.

The Elliott-Fisher Co. has acquired the business of the Sundstrand Corporation, manufacturer of Sundstrand adding, bookkeeping and calculating machines, with factories and general offices at Rockford, Ill. The Elliott-Fisher Co. manufactures accounting-writing machines and has factories at Harrisburg, Pa., and general offices in New York. The latter company desired to supplement its line with equipment for the adding-bookkeeping field, and for that reason acquired the Sundstrand organization. The products of the two constituent organizations will be marketed by the General Office Equipment Corporation, a subsidiary of the Elliott-Fisher Co. The same officers of the General Office Equipment Corporation continue in the management of the organization, with executive and general sales offices at 342 Madison Ave., New York.

Stockholders of the American Brown Boveri Electric Corporation unanimously approved the election of directors previously named by the voting trustees. The following fourteen men now compose the board: Clifford Bucknam, James I. Bush, Allen Curtis, William M. Flook, Edward N. Goodwin, William V. Griffin, James Imbrie, William F. Ingold, Henry Lockhart Jr., John J. Rudolf, Theodore G. Smith, Elisha Walker, Frank R. Warton and Laurence R. Wilder, president of American Brown Boveri.

Theodore Boveri, son of the late Walter Boveri, one of the founders of the corporation, has been named a vice-president. For several years he has been responsible for design and manufacture in the corporation's works in Baden, Switzerland. Other officers, in addition to Mr. Wilder, are Clinton L. Bardo, W. G. Groesbeck, Earle G. Hines and Mr. Warton, vice-presidents; Norman R. Parker, controller; J. T. Wickersham, secretary and treasurer, and Mr. Flook, who is chairman of the executive committee.

Personals

GERARD SWOPE, president of the General Electric Co., sailed on Jan. 5 for Gibraltar, Genoa and Naples.

JOHN GEHRING has been appointed chief engineer of the Beaver Machine and Tool Co., of Newark, N. J.

DALLAS B. PRATT and F. F. FITZPATRICK have been elected directors of the American Car and Foundry Co.

JOHN D. MANSFIELD, president of the Chrysler Corporation of Canada, announces that the Fisher body plant in Ford City, after having been closed for three years, will reopen.

WALTER E. HARRIS, who has been identified with the Stephens-Adamson Manufacturing Co., of Aurora, Ill., manufacturer of transmission and screening machinery, has been appointed district manager of the company's branch at 1108 Martin Bldg., Birmingham, Ala.

HAROLD YOUNGREN, chairman of the Buffalo, N. Y., section of the Society of Automotive Engineers, and chief engineer for the Pierce-Arrow Motor Car Co., is leaving Buffalo for South Bend to become designing engineer for the Studebaker Corporation.

JOHN A. COE, president of the American Brass Co., Waterbury, Conn., vice-president of the American Metal Hose Co., Waterbury, and president of the Waterbury Brass Goods Corporation, has been elected a director of the Anaconda Copper Mining Co., to fill the vacancy caused by the death of Charles F. Brooker.

POWEL CROSLEY JR., of Cincinnati has been elected president of the De Forest Radio Co. Dr. Lee De Forest was elected vice-president and a new board of directors consists of Mr. Crosley, Dr. De Forest, Lewis M. Crosley, Charles Sawyer, James I. Bush, A. D. Lord and R. E. Field. Dr. De Forest will continue as chief engineer.

M. B. URQUHART, who has been Northwestern manager for the Keystone Lubricating Co., of Philadelphia, for the past twenty years, has resigned that position and has become Western manager of the Philadelphia Grease Manufacturing Co., of Philadelphia. He is located in the company's offices in Denver, Col., and also at 144 S. Fifth West St., Salt Lake City, Utah.

D. F. EDWARDS was recently elected president of the Saco-Lowell Shops, of Maine and Massachusetts, to succeed Robert F. Herrick, who continues with the company as a member of the board of directors. He was for several years vice-president of the Wickwire Steel Co., and has more recently been associated with Charles W. Nash, of the Nash Motors Co. The Saco-Lowell company manufactures textile machinery.

FRED S. DORAN has been appointed manager of the Cleveland plant of Joseph T. Ryerson & Son, Inc. This new warehouse plant of the Ryerson company was purchased this month from the Bourne-Fuller Co., of Cleveland. Mr. Doran has been associated with Joseph T. Ryerson & Son for 21 years. Beginning in the office he traveled the Wisconsin territory for five years, then covered the Chicago territory for some time, until he was made assistant to the general manager of sales.

Obituaries

HAROLD E. LEHMAN, experimental engineer for the Auburn Motor Car Co., Auburn, Ind., died recently in Indianapolis after a short illness. He was at one time sales manager for the Wheeler-Schebler Carburetor Co., of Indianapolis.

CLINTON H. SCOVELL, founder of the firm of Scovell, Wellington & Co., cost accountants, and former president of the National Association of Cost Accountants, died at his home in Newton, Mass., on Jan. 1. He was widely known as an expert on accounting and industrial engineering and was the author of several books on these subjects.

Chicago R.R. Wages

All shopmen in the employ of the C. & N. W. R.R. have received an increase in wages of three cents per hour beginning January 1, following a similar increase in pay announced by the C. M. & St. Paul R.R. effective Dec. 15. The restoration of time and one-half on the former road for overtime, Sunday and holiday work also is announced. Rail employees in the Chicago district to the number of 30,000 are now receiving increases in pay.

Calendar of Local Meetings

A.S.M.E.

Chicago. Jan. 20. Western Society of Engineers, joint meeting with A.I.M.M.E. Subject: Mechanization of the Coal Mines.

Virginia. Jan. 21. Joint meeting of sections of A.S.C.E., A.I.E.E. and A.S.M.E., with Engineers' Club, at Norfolk.

New Britain. Jan. 26. Engineers' Club, Bristol, Conn. Subject: Manufacturing Small Tools, by A. H. D'Arcambal, metallurgist, Pratt & Whitney Co.

Metropolitan. Jan. 31. Engineering Societies Bldg., New York. Subject: Advanced Methods in Power Generation. Speaker, Bert Houghton, Brooklyn Edison Co.

Society of Automotive Engineers

Southern California. Jan. 14. Subject: Trailers and Semi-Trailers. Papers by representatives of several manufacturers.

New England. Jan. 18. Subject: Gas-Electric Buses. Speaker, M. E. Toepel.

Dayton. Jan. 20. Subject: Some Thoughts on the Use of Highways. Speaker, Dr. H. C. Dickinson.

National Association of Cost Accountants

Erie Chapter. Jan. 17. "Department Burden, Overhead and Selling and Administrative Cost," by C. H. Scovell.

Hartford Chaper. Jan. 18. "Debatable Subjects of Mutual Interest to Foremen, and Team Work between Foremen," by H. G. Crockett.

Kansas City Chapter. Jan. 17. "Where the Cost Accountant and Engineer Meet."

Los Angeles Chapter. Jan. 18. "Costs of Selling."

Milwaukee Chapter. Jan. 20. by F. H. Elwell.

Philadelphia Chapter. Jan. 21. "Building and Loan Association," by Edward P. Moxey.

Rochester Chapter. Jan. 19. "The Business Outlook for 1927," by J. C. Howell.

St. Louis Chapter. Jan. 18. "Appraisals and Their Relation to Costs," by H. G. Baldwin.

Springfield Chapter. Jan. 19. "Business Outlook for 1927," by Ray Vance.

Syracuse Chapter. Jan. 18. "Why Systems Fail," by Robert Anderson.

Twin Cities Chapter. Jan. 18. "How-We-Do-It in Department Stores," by W. A. Dillman.

Forthcoming Meetings

American Society for Steel Treating. Winter Sectional Meeting, Washington, D. C., Jan. 20 and 21, 1927. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. E. F. Lowe, chairman, meetings and sections department, 29 West 39th St., New York.

American Railway Association. Engineering Division, March 8 to 10, at Chicago; Mechanical Division, June 7 to 10, at Montreal; Purchases and Stores Division, date and place not yet announced. H. J. Forster, secretary, 30 Vesey St., New York City.

Lyons Fair. Opens first Monday in March, and continues for two weeks, at Lyons, France. Exhibits of many products including tools and implements, industrial supplies, metallurgy and machinery. Emile Garden, 50 Church St., New York, is the representative of the fair in the United States.

American Society of Mechanical Engineers. Regional meeting, Kansas City, Mo., April 4 to 6. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Metal Trades Association. Annual convention, Hotel Statler, Detroit, Mich., April 25 and 26. J. E. Nyhan, secretary, Peoples Gas Bldg., Chicago, Ill.

American Welding Society. Annual meeting, Engineering Societies Bldg., New York, April 27, 28 and 29. M. M. Kelly, secretary, 33 West 39th Street, New York.

American Society for Steel Treating. Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

National Foreign Trade Council. Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

Society of Industrial Engineers. Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

American Foundrymen's Association. Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Supply and Machinery Distributors' Association. Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association**, and the **American Supply and Machinery Manufacturers' Association**, on board the steamship *Noronic*. Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia.

American Society for Steel Treating. Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

Machine Tool Exhibit. Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

National Machine Tool Builders' Association. First exposition of machine tools at Public Hall, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, chairman of the exposition committee. Robert Everett, manager, 1328 Broadway, New York City.

The Weekly Price Guide

Rise and Fall of the Market

IMPROVEMENT in the pig-iron market is barely perceptible in some of the principal centers of distribution; prices are down in Philadelphia and Pittsburgh districts. Finished steel does not show as many signs of early resumption of activities as are evident in iron; quotations on the principal hot-rolled products have finally lost all traces of the $2.10 per 100 lb. figure and settled down to $2 per 100 lb. f.o.b. Pittsburgh mill, on shapes and bars, with plates holding firmly to the $1.90 level. Non-ferrous metals remain slow, with sharp declines reported in copper and lead, which may in turn affect fabricated products used in the shop.

(All prices as of Jan. 7)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.89
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	28.17
Basic	21.76
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00@4.50
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.25@2.30	3.50	3.25	3.89
No. 12	2.30@2.35	3.55	3.30	3.94
No. 14	2.35@2.40	3.60	3.35	3.99
No. 16	2.45@2.50	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90@3.05	3.75	3.60	4.15
No. 22	3.05@3.20	3.90	3.75	4.30
No. 24	3.10@3.25	3.95	3.80	4.35
No. 26	3.20@3.35	4.05	3.90	4.45
No. 28	3.35@3.50	4.20	4.05	4.60
Galvanized				
No. 10	3.15@3.25	4.10	3.95	4.40
Nos. 12 to 14	3.25@3.35	4.20	4.05	4.50
No. 16	3.35@3.45	4.30	4.15	4.60
No. 18	3.50@3.60	4.45	4.30	4.75
No. 20	3.65@3.75	4.60	4.45	4.90
No. 22	3.70@3.80	4.65	4.50	4.95
No. 24	3.85@3.95	4.80	4.65	5.10
No. 26	4.10@4.20	5.05	4.90	5.35
No. 28	4.35@4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
065"	16	.19	.20	.21	.22	.23	.25	.27
083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	4.50	6.00@7.50	4.65
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (2.90@3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅜", 8.35c.; ¼, 7.85c.; ⅛ to 5/32, 7.35c. per lb. *Flat, ⅛@½-in. thick.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.50
Tin, 5-ton lots, New York			68.00
Lead (up to carlots) E. St. Louis	7.65	New York	8.37½
Zinc (up to carlots) E. St. Louis	6.92½	New York	7.87½

	New York	Cleveland	Chicago
Antimony (Chinese) ton spot	15.50	16.50	15.00
Copper sheets, base	22.25	22.00	22.00
Copper wire, base	19.12½	19.00	15.62½
Copper bars, base	21.87½	21.62½	21.62½
Copper tubing, base	24.25	24.00	24.00
Brass sheets, high, base	18.62½	18.37½	18.37½
Brass tubing, high, base	23.50	23.25	22.75
Brass rods, high, base	16.37½	16.12½	16.12½
Brass wire, high, base	19.12½	18.87½	18.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.00	12.80	12.01
Solder (½ and ½), (case lots)	41.00	44.50	38½@42½

Babbitt metal, delivered, New York, cents per lb.:

Genuine, highest grade	86.00
Commercial genuine, intermediate grade	61.50
Anti-friction metal, general service	32.50
No. 4 babbitt (f.o.b.)	13.50

Nickel, f.o.b. refinery, cents per lb.:

Ingots	35.00	Electrolytic	39.00
Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.50 @11.75	11.00	10.50@11.00
Copper, heavy, and wire	10.75 @11.25	11.25	10.00@10.50
Copper, light, and bottoms	9.25 @ 9.75	9.50	8.75@ 9.25
Heavy lead	6.37½@ 6.87½	6.50	6.00@ 6.50
Tea lead	4.50 @ 5.00	4.50	4.75@ 5.25
Brass, heavy, yellow	7.00 @ 7.25	7.25	6.50@ 7.00
Brass, heavy, red	9.00 @ 9.25	9.25	8.50@ 9.00
Brass, light	5.50 @ 5.75	6.00	6.00@ 6.50
No. 1 yellow rod turnings	7.75 @ 8.00	7.50	7.25@ 7.75
Zinc	4.25 @ 4.50	4.00	3.50@ 4.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0.20
Cotton waste, colored, per lb.	.09@ .13	.13½	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 175 lb. keg	2.80	2.75	2.75
Roll sulphur, per lb	.04	.03½	.04
Linseed oil, per 7½-lb. gal., 5 bbl. lots	.81	.98	83
Lard cutting oil, 25% lard, per gal.	.55	.50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
Firrt grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.04
Brass rods	per lb	.1637½	.1637½	.1687½
Solder (½ and ½)	per lb.	.41	.43	.4025
Cotton waste	per lb.	.13@17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	35
Belting, leather, medium	off list	40–5%	40–5%	40–5%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.13
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	27.84
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.32
Cloth	3.10	3.50	3.05
Fire clay, per 100 lb. bag		.75	75
Coke, prompt furnace, per net ton	Connellsville,		3.75@4.00
Coke, prompt foundry, per net ton	Connellsville,		4.50@5.50
White lead, dry or in oil, 100 lb. kegs	New York,		15.25
Red lead, dry, 100 lb. kegs	New York,		15.25
Red lead, in oil, 100 lb. kegs	New York,		16.75

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger. Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ½-in., ⅝-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Bridgeport—Lucas & Son—600 to 800 ton Bliss or Toledo coining press.

Ky., Weeksbury—E. A. Rikard, Ch. Electrician c/o Elkhorn Piney Coal Mining Co. wheel lathes for mine repair shop.

Mass., Everett (Boston P. O.)—Maltzman & Rovner, 22 Summer St.—miscellaneous tools and equipment for proposed garage and repair shop at Chelsea and Clinton Sts. Estimated cost $45,000.

Mass., Roxbury (Boston P. O.)—G. F. Golub, 12 Garden St.—tools and equipment for proposed 1 story, 100 x 190 ft. repair and service garage at 812 Huntington Ave. here. Estimated cost $50,000.

Mass., Somerville (Boston P. O.)—M. Bornstein, 64 Charlesgate East, Boston,—miscellaneous tools and equipment for proposed addition to repair and service garage at Elm and Washington Sts. here. Estimated cost $50,000.

Mich., Jackson—L. W. Lamb, 501 West Michigan Ave.—prices and catalogs on light weight caterpillar gas crane, ¾ yd. clam.

N. J., Trenton—J. S. Lutz, c/o Free Bridge Motors Co., Morrisville, Pa.—modern machinery and equipment for proposed garage and service station at West Hanover and Willow Sts. here. Estimated cost $35,000.

N. Y., New York—Acetylene Welding & Cutting Co., 157 Spring St.—one 24 or 26 in. lathe, 7 ft. between centre, one 20 or 24 in. shaper, etc.

O., Bridgeport—E. Jones, 323 North Lincoln Ave.—18 or 20 in. lathe with 10 or 20 ft. bed.

O., Canton—The Luehrs Co., 118 St. Clair Ave., Cleveland, D. M. Luehrs, Pres. (conveying machinery)—2 and 5 ton cranes for proposed 1 story, 101 x 122 ft. factory. Estimated cost $60,000.

O., Cleveland—Silver Kaden Electric Co., 4121 Woodland Ave. H. E. Kaden, (light fixtures)—Bliss press, No. 2¼.

O., Columbus—Winders Motor Sales Co., 783 North High St., W. Winders, Pres.—complete equipment for new service station on North High St.

Pa., East Pittsburgh — Westinghouse Electric & Mfg. Co.—80 items including turret lathes, grinders, milling machines, lathes and drill presses. (1st quarterly list.)

Pa., Pittsburgh — Carnegie Steel Co., Carnegie Bldg., C. Miller, Purch. Agt.—special locomotive crane for warehouse at Houston, Tex.

Pa., Pittsburgh—Jones & Laughlin Steel Corp., Third Ave. and Ross St.—15 overhead electric cranes, 5 to 20 ton capacity for new seamless tube mill at Woodlawn, Pa.

Pa., Pittsburgh—The Thomas Co., Fulton Bldg. (machinery)—friction saw, capacity up to 20 in. beams.

Tex., Weslaco—Weslaco Auto Co.—machinery and equipment including 2 drill presses, 1 bolt cutter, 1 threader and 1 lathe for proposed 2 story garage. Estimated cost $50,000.

India, Ram Gali, Lahore—Puujab Engineers Supply Co.,—prices and catalogs on machinery for the manufacture of wire nails, horse shoes, horse shoe nails and chain for oxen, bullocks and cattle, also wire and materials for same.

Opportunities for Future Business

Ark., El Dorado—J. G. Mitchell, plans the construction of a 2 story, 100 x 150 ft. garage and service station. Estimated cost $75,000.

Calif., Los Angeles—Troy Motor Sales Co., c/o Morgan, Walls & Clements, Van Nuys Bldg., Archts., is having preliminary plans prepared for the construction of a 4 story, 150 x 203 ft. garage and service building at Wilshire Blvd. and Shatto Pl. Noted Dec. 9.

Calif., Richmond—Decora Mfg. Co., 448 Larkin St., San Francisco, manufacturers of paint and lacquer spraying equipment, plans the construction of a factory here. Estimated cost $40,000.

Calif., San Jose—Helwig Iron Works, 69 Almaden Ave., will build a shop and foundry on Vine St. Estimated cost $11,250.

Conn., Bridgeport—H. F. Holbrook-Henry Brewster Corp., 1720 Fairfield Ave., manufacturers of auto bodies, is having plans prepared for the construction of addition to plant. Estimated cost $40,000. Fletcher-Thompson Inc., 542 Fairfield Ave., Archt.

Conn., Hartford—Packard Motor Co., 150 Washington St., awarded contract for the construction of a 2 story, 125 x 145 ft. addition to plant at Park and Washington Sts. Noted Dec. 23.

Ill., Chicago — Robbins Mfg. Co., 1815 North Central Park Ave., manufacturers of insect screens, awarded contract for the construction of a 1 story factory. Estimated cost $18,000.

Ind., Bloomington—Showers Bros., manufacturers of furniture, is having plans prepared for the construction of a factory. Estimated cost $400,000. H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O., Archts.

Mass., Chelsea (Boston P. O.)—J. H. Reagan, 154 Lexington St., Cambridge, will build a 1 story, 100 x 150 ft. repair and service garage on Second St. Estimated cost $50,000. Private plans.

Mass., Dorchester (Boston P. O.) — Joseph Pollak Tool & Stamping Co., Inc., 81 Freeport St., is receiving bids for the construction of a 3 story, 50 x 70 ft. addition to factory. Miller & Levi, 46 Cornhill, Boston, Archts.

Mass., East Boston (Boston P. O.)—E. Sorrentine, 82 Porter St., is receiving bids for the construction of a 1 story, 50 x 100 ft. repair and service garage at 152 Paris St. Estimated cost $40,000. B. C. Gallo & Co., 42 Maverick Sq., Archts.

Mass., East Cambridge (mail Boston)—Federal Iron Works, 119 First St., awarded contract for the construction of a 1 story addition to factory at 11 Brattle Sq. Estimated cost $40,000.

Mass., Everett (Boston P. O.)—Maltzman & Rovner, 22 Summer St., are having revised plans prepared for the construction of a 1 story, 85 x 140 ft. repair and service garage at Chelsea and Clinton Sts. Estimated cost $45,000. S. E. Moffie, 51 Cornhill, Boston, Archt. Former bids rejected.

Mass., Jamaica Plain (Boston P. O.)—J. C. Magnet, 18 Tremont St., Boston, awarded contract for the construction of a 1 story repair and service garage at Floyd & Basswood Sts. here. Estimated cost $100,000.

Mass., New Bedford—Tourists Garage, 125 Middle St., plans the construction of a 1 story repair and service garage. Estimated cost $50,000. E. G. Bullard & Son, 88 Purchase St., Archts.

Mass., Newton (Boston P. O.)—P. A. Murray & Co., 210 Washington St., are receiving bids for the construction of a 2 story repair and service garage. Estimated cost $40,000. Private plans. Noted Jan. 6.

Mo., Kansas City—Galion Iron Works & Mfg. Co., Galion, O., awarded contract for the construction of a 1 story warehouse and service building. Estimated cost $75,000.

Mo., Kansas City — Weber Engine Co., 1101 Winchester St., will build a 1 story, 50 x 100 ft. foundry. Estimated cost $7,000. Private plans.

N. Y., New York—F. Small, 215 Montague St., Brooklyn, is having plans prepared for the construction of a 7 story, 100 x 150 ft. garage at 318 West 49th St. here. Estimated cost $350,000. E. DeRosa, 15 West 44th St., Archt.

O., Canton—Luehrs Co., 118 St. Clair Ave., Cleveland, manufacturers of conveying machinery, awarded contract for the construction of a 1 story, 101 x 122 ft. factory here. Estimated cost $60,000. Noted Dec. 23.

O., Cleveland—The Cleveland Gasket & Mfg. Co., H. A. Lindsley, Mgr., 1610 West 116th St., is receiving bids for the construction of a 3 story, 80 x 120 ft. factory at 1602 West 116th St. Estimated cost $75,000. G. F. Hammond, Zanesville, Archt. Noted Jan. 6.

O., Cleveland—W. J. Daubenspeck, 1371 East 115th St., had plans prepared for the construction of a 1 story, 83 x 294 ft. garage, sales and service station at Collamer and Euclid Aves. Estimated cost $100,000. W. J. Wefel, 5716 Euclid Ave., Archt.

O., Mogadore—Comwall Quality Tool Co., J. F. Kemmerlein, Secy., Cuyahoga Falls, manufacturers of steel tools, plans the construction of a 1 story factory here. Estimated cost $60,000.

Ore., Portland—The Portland Electric Power Co., Electric Bldg., awarded contract for the design and construction of a 100 x 240 ft. garage to The Austin Co., 16112 Euclid Ave., Cleveland, O.

Tex., Dallas—R. J. Coke, American Exchange Bank Bldg., will receive bids about Jan. 15 for the construction of a 4 story, 103 x 137 ft. garage. L. R. Whitson, 1805 Santa Fe Bldg., Archt.

Wis., Janesville—Northern Conveyor Co., West State St., plans the construction of a 1 story addition to factory. Private plans.

Wis., La Crosse—Standard Oil Co., 910 South Michigan Ave., Chicago, Ill., will soon receive bids for the construction of machine shop, garage, etc. here. Estimated cost $100,000. R. N. Allen, c/o owner, Archt.

Wis., Milwaukee—Bradley Wash Fountain Co., 2203 Clybourn St., awarded contract for the construction of a 1 story, 60 x 100 ft. factory. Estimated cost $40,000.

Wis., Milwaukee—Marcus Realty Co., 1368 31st St., awarded contract for the construction of a 3 story, 82 x 150 and 60 x 100 ft. warehouse and garage on 30th St. Estimated cost $100,000. Hartman Furniture & Carpet Co., 144 South Wabash Ave., Chicago, Ill., lessee.

B. C., Vancouver—Simmons Ltd., 2034 10th Ave. W., manufacturers of steel beds, etc., will receive bids about Jan. 21 for the construction of a 4 story, 50 x 100 ft. factory. Estimated cost $50,000. Townley & Matheson, 325 Homer St., Archts.

Ont., Forest Hill—Myers Lumber Co., Spadina Rd. and Eglinton Ave., is having plans prepared for the construction of a 1 and 2 story woodworking plant to replace fire loss. Estimated cost $150,000.

Ont., Toronto—Canadian Wirebound Boxes Ltd., 1,000 Gerard St. E., plans the construction of a warehouse and factory. Estimated cost $200,000. Private plans.